FM 21-40

WAR DEPARTMENT FIELD MANUAL

DEFENSE AGAINST CHEMICAL ATTACK

WAR DEPARTMENT • SEPTEMBER 1946

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This manual supersedes FM 21-40, 7 September 1942, including C1, 11 September 1943, C2, 20 December 1943, C3, 28 April 1944, C4, 15 September 1944 and C5, 1 May 1945.

DEFENSE AGAINST CHEMICAL ATTACK

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CONTENTS

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PART ONE
INTRODUCTION: PURPOSE AND SCOPE

1. PURPOSE. This manual has a dual purpose. It is intended to be a handbook on chemical warfare defensive measures necessary for the protection of the field forces; and a guide to training in defense against chemical attack for all officers and noncommissioned officers.

2. SCOPE. The subject matter is concerned only with chemical warfare defensive measures and is intended primarily for basic troop training. Chemical warfare offensive measures are presented elsewhere in appropriate manuals concerned with the tactical employment of chemical munitions and weapons.

3. ARRANGEMENT. The manual is subdivided into three parts:

a. Part One—Introduction.

b. Part Two—Defense Against Chemical Attack. This subdivision presents a basic consideration of the responsibilities, protective equipment, and protective techniques for defensive measures against chemical attack. During combat, this section may be utilized as a handbook for protection against chemical attack by chemical officers and unit gas personnel.

c. Part Three—Training for Defense Against Chemical Attack. This subdivision presents a series of train-

ing outlines for use in qualifying appropriate personnel at each succeeding level of responsibility for protection against chemical attack.

4. ADDITIONAL TECHNICAL AND LOGISTICAL REFERENCES. As indicated above, this manual is designed primarily for basic troop training. Chemical officers, unit gas personnel, and other interested personnel may require more detailed technical data which is presented in other 3-series manuals and publications.

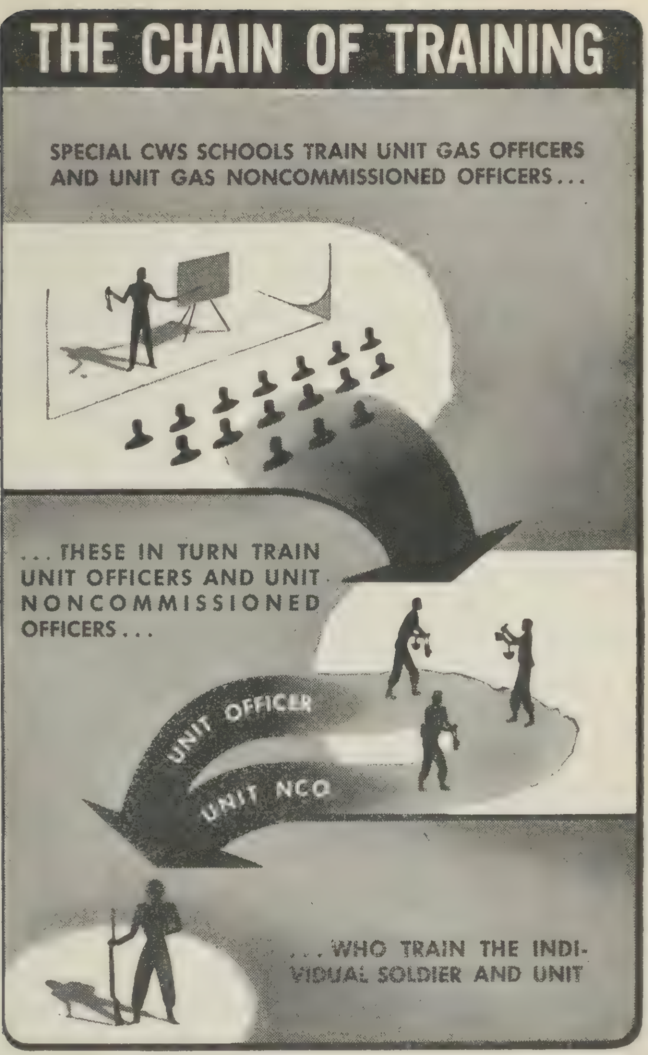


Figure 1. The chain of training.

PART TWO
DEFENSE AGAINST CHEMICAL ATTACK

CHAPTER I
INTRODUCTION

5. WHAT IS DEFENSE AGAINST CHEMICAL ATTACK? Defense against chemical attack is the application of necessary measures by an individual or unit for protection against the use of chemical agents. Chemical agents are defined in paragraphs 15 through 19, and are used in combat to kill, injure, or harass personnel; deny observation; or burn materiel. Practical defenses against combat use of chemical agents have been developed and can be readily learned by the individual. Military personnel who are well-trained in these defenses, respect, but do not fear chemical agents.

6. RESPONSIBILITY FOR DEFENSE AGAINST CHEMICAL ATTACK. The unit commander is responsible for the training of his unit and the individuals in that unit in chemical warfare defensive measures, and for the protection of his unit against chemical attack.

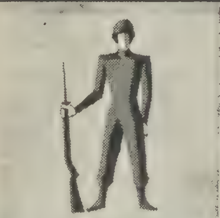
7. KINDS OF DEFENSE AGAINST CHEMICAL ATTACK. **a. Active defensive measures.** Active defensive measures hamper the enemy's use of chemical agents through offensive action. For example, weapons used by the enemy to project chemical agents, chemical ammunition dumps, or enemy chemical depots and arsenals in rear areas may be

neutralized or destroyed by aircraft bombardment or artillery fire.

b. Passive defensive measures. Passive defensive measures limit effectiveness of the enemy's chemical attack. They include wearing gas masks, protective clothing, and other protective equipment; use of gasproof shelters; personal decontamination and first aid.

8. CHEMICAL WARFARE DEFENSIVE MEASURES AND THE MISSION. Defensive measures against chemical agents must be taken during combat action to the maximum extent possible without undue interference with the accomplishment of the mission. Through a series of practical situations during field training, individuals must be taught to apply chemical protective measures, including the use of protective equipment, without undue exposure to either the effects of chemical agents or enemy fire and without jeopardizing the accomplishment of the mission.

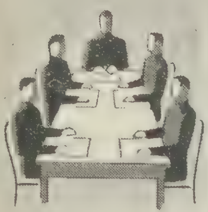
GENERAL DUTIES OF PERSONNEL IN CHEMICAL DEFENSE



The individual soldier must have a knowledge of chemical defensive measures so that he can carry out his mission with the least risk of injury.

In addition, unit officers and non-commissioned officers must be able to teach individual chemical defensive measures to the soldier, to provide for collective and tactical defense, and to use organizational first aid equipment and detection devices.

Unit gas personnel are technical advisers to the unit commander; they assist him in any situation in which the enemy employs chemical agents.



Chemical staff officers have additional duties in relation to the chemical defense of the entire command. They must have the technical information required for their more extensive duties.

Figure 2. General duties of personnel in chemical defense.

CHAPTER 2
RESPONSIBILITIES FOR DEFENSE AGAINST CHEMICAL ATTACK

9. GENERAL. a. Command responsibilities. The chemical warfare training of the unit, and of the individuals in the unit, and the protection of the unit against chemical attack are responsibilities of command. These responsibilities include the proper fitting of the gas mask to all individuals of the unit, the preparation of a gas defense plan for the unit, the designation of decontamination squads appropriate in number and strength to the size of the unit, and the proficiency of all personnel of the unit to perform their respective duties in a chemical situation with the minimum loss of efficiency. A general statement of the duties of personnel are shown in figure 2.

b. Organization. The commander of a unit smaller than a division is assisted by gas defense personnel in discharging his chemical warfare responsibilities. Gas defense personnel are selected officers and enlisted men of the arm or service of the unit who have been especially qualified in chemical protection, intelligence, and supply, and are appointed by the unit commander. Tactical units, such as divisions and larger units, have chemical sections in the unit special staffs with an assigned Chemical Corps officer as chemical officer. The chemical officer and his relation to his commander, and the relationship between the unit gas personnel and the unit commander of the lower units is shown in figure 3. The remaining paragraphs in this chapter outline in greater detail

the duties, responsibilities, and training of personnel at each operating level in a unit.

10. THE INDIVIDUAL. Standards of proficiency which must be attained by the individual, together with the minimum training required to attain these standards, are prescribed in paragraphs 87 through 118. These standards list the individual's responsibilities for his personal protection against chemical attack, for the care and serviceability of his protective equipment, and for his part in collective and tactical defense measures. By means of the information contained in paragraphs 87 through 118, each unit commander can insure that all the personnel in the unit are thoroughly familiar with the basic chemical defensive measures; and that a prescribed standard is available through which their knowledge can be periodically tested and refreshed.

11. ALL OFFICERS AND NONCOMMISSIONED OFFICERS. Officers and noncommissioned officers assigned to the unit normally conduct the chemical warfare training of the soldier and the unit. In operations, they insure the tactical and collective protection of their units against chemical attack. Since any officer may be called upon to conduct training of military personnel, it is essential that all officers attain a degree of proficiency in chemical warfare which is more comprehensive than the basic knowledge required of the individual soldier. Standards of proficiency for all officers and noncommissioned officers and the training required to attain this proficiency are prescribed in paragraphs 119 through 122.

12. UNIT GAS DEFENSE PERSONNEL. Unit gas defense personnel include gas officers, gas noncommissioned officers, and their alternates, all appointed by their unit commander. (See figure 3.) Unit gas personnel conduct the chemical warfare training of unit officers and noncommissioned officers, and assist in the training of the individual and the unit. They are required to have specialized chemical warfare training above the standards established for the individual soldier and unit officers and noncommissioned officers. This training will be acquired at chemical warfare schools conducted by chemical officers of divisions or higher units. Organizational duties assigned to unit gas personnel must be such as to give a minimum of interference with their chemical defense duties. The duties and training of unit gas personnel are prescribed in paragraphs 123 through 127.

a. Unit gas officers. Each combat or service company, battalion, regiment, and similar unit will have a minimum of one qualified unit gas officer with a qualified alternate appointed by the unit commander. (See figure 3.) Additional alternates should be appointed. These officers are members of the arm or service of the unit to which they are regularly assigned, and should be qualified in their duties through completion of the prescribed chemical warfare training. In technical chemical matters they have direct communication with the chemical officer of the next higher echelon. Close cooperation between unit gas officers and chemical officers of higher echelons is essential since unit

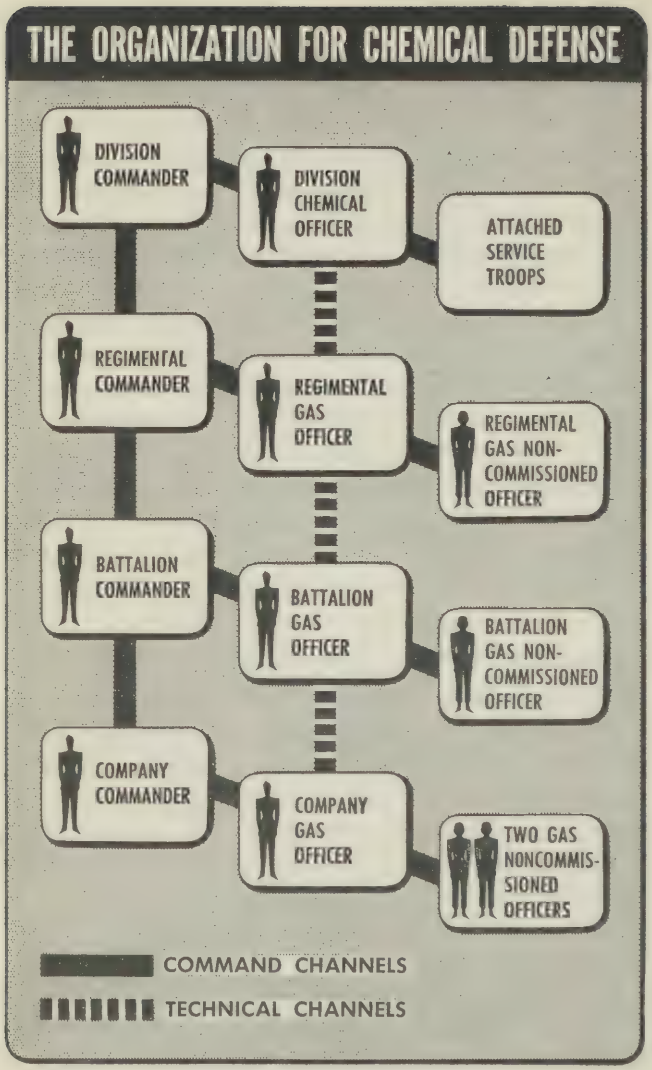


Figure 3. Organization of chemical defense.

gas officers represent their commanders in chemical warfare matters. The unit gas officer of each echelon supervises (through channels) the chemical activities of the gas personnel of subordinate units.

b. Unit gas noncommissioned officers. Gas noncommissioned officers will be appointed by the unit commander on the basis of a minimum of one to each battalion and regiment and two to each company. (See figure 3.) A qualified alternate will be appointed (more than one may be designated) for each required unit gas noncommissioned officer. Unit gas noncommissioned officers assist the unit gas officer in the performance of his chemical duties and should be qualified in duties by completion of the prescribed course of training.

13. THE CHEMICAL STAFF OFFICER. The duties and training of the chemical officer are prescribed in paragraphs 128 through 136.

a. Ground forces. A Chemical Staff Section is organic in each division or higher combat unit, department, and post. Chemical Corps officer and enlisted personnel are assigned to each of these sections which constitute a part of the Special Staff of the Headquarters. The senior Chemical Corps officer assigned to a headquarters is designated as the chemical officer. He is the technical expert for his commander on all matters pertaining to chemical warfare. He establishes Chemical Warfare Schools for training unit gas officers and gas noncommissioned officers. He exercises technical supervision over the chemical warfare activities of lower echelons, and main-

tains close liaison with the chemical officers of higher, lower, and adjacent commands.

b. Air forces. Chemical Staff Sections are provided in each air force and higher unit. The air force chemical officers and the staff sections have duties paralleling those of ground forces chemical officers. (See FM 3–6.)

c. Post chemical officer. The post chemical officer, as directed by the army or appropriate air force commander, is responsible to the post commander, for chemical defensive training, supply, and for post security against chemical attack. At posts having consolidated station property accounting, he gives technical advice only in chemical warfare supply matters and does not handle supply duties. At other posts, his duties include chemical warfare supply.

d. Service elements. Chemical warfare sections are provided in communications zone and zone of interior service elements on the basis of individual requirements. The senior Chemical Corps officer assigned in the section is the chemical officer. His duties generally are concerned with the service of supplies, collection of technical chemical warfare intelligence data. and the administration and training of attached or assigned Chemical Corps troop units.

14. SPECIAL TROOPS AND DETACHMENTS. Chemical service troops are assigned or attached as needed for supply and maintenance of chemical equipment and munitions, decontamination, intelligence, chemical analysis, and special smoke operations. (These troops are listed in figure 36.)

CHAPTER 3
CHEMICAL AGENTS AND THEIR IDENTIFICATION

15. DEFINITIONS. a. Chemical agents. Chemical agents are substances which, through their chemical properties, produce lethal, injurious, or irritant effects, a screening smoke, or an incendiary action. The three main groups are war gases, screening smokes, and incendiaries. (See figure 4.)

b. War gas. War gas is a term which, through common usage, applies to toxic or irritant agents, irrespective of their physical state.

Note. The first war gases were literally gases—that is, they were in a gaseous state; hence the origin of terms such as "gas warfare" and "gas mask." These terms were short and convenient; so they continued in use even after introduction of such agents as mustard gas (which is a liquid at ordinary temperature) and irritant smokes (which are finely divided solid particles). To the chemist, "war gas" is a misnomer if applied to mustard gas; and "liquid blister gas" is a contradiction of terms. But in its war application, "war gas" (or even "gas") is a specialized military term, sanctioned by long use. It is so used in this and other War Department publications.

c. Concentration. Concentration is the amount of war gas or screening smoke present in a given volume of air.[1]

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[1] Concentration may be expressed in milligrams per cubic meter (mg/m^3), milligrams per liter (mg/1), or ounces per 1,000 cubic feet (oz/1,000 cu ft). Milligrams per liter and ounces per 1,000 cubic feet are almost identical numerically. Concentrations in milligrams per liter, multiplied by 1,000 give concentrations in milligrams per cubic meter.

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CLASSIFICATION OF

BY PHYSICAL STATE

SOLID
LIQUID
GAS
} Chemical agents may be solids, liquids, or gases.

BY TACTICAL USE

CASUALTY GASES are those capable of producing serious injury or death in field concentrations.

HARASSING GASES are those which force masking and slow operations. Only those which produce this result with a small quantity of munition are considered primarily as harassing.

SCREENING SMOKES are those which, when burned, hydrolyzed, or atomized, produce an obscuring smoke; they are used to deny observation and reduce effectiveness of aimed fire.

INCENDIARIES are those used primarily for setting fires. They may cause casualties from burns.

> NOTE: Many chemical agents have more than one tactical use. In such cases, the most important use determines the primary classification.

BY PHYSIOLOGICAL ACTION

BLISTER GASES (sometimes called *vesicants)* are gases readily absorbed by both exterior and interior parts of the body, causing inflammation, blisters, and general destruction of tissue. Blister gas vapors attack the respiratory tract, and effects are usually more severe in the upper tract. Eyes are very susceptible.

CHOKING GASES (sometimes called *lung irritants)* cause irritation and inflammation of bronchial tubes and lungs. Their

Figure 4. Classification of chemical agents.

primary physiological action is limited to the respiratory tract, injury extending to deepest parts of the lungs.

BLOOD AND NERVE POISONS (sometimes called *systemic poisons)* cause injury after they are absorbed into the blood stream.

VOMITING GASES (sometimes called *irritant smokes* or *sternutators)* cause coughing, sneezing, pain in nose and throat, nasal discharge, and sometimes tears, often followed by headache.

TEAR GASES (sometimes called *lacrimators)* cause copious flow of tears and intense (although temporary) eye pain.

NOTE: The physiological classification omits screening smokes and incendiaries; however, white phosphorus (as an incendiary) and other incendiaries produce casualties.

BY PERSISTENCY

(Persistency means length of time a war gas normally remains effective in the open at point of dispersion. "Effective" means gas is capable of producing casualty or other intended effect on unprotected personnel.)

NONPERSISTENT GASES are those normally effective in the open 10 minutes or less at the point of dispersion.

PERSISTENT GASES are those normally effective in the open at the point of dispersion more than 10 minutes. Further division: *moderately persistent* (10 minutes to 12 hours); *highly persistent* (more than 12 hours).

NOTE: Persistency usually decreases as rate of vaporization increases. Vaporization increases with heat, wind, and fineness of dispersion; thus, any given persistent gas is apt to be *less persistent* in hot weather, when exposed to wind, or when dispersed as fine spray. Even *nonpersistent* gases may persist for hours when collected in low, sheltered places and favored by cold, dampness, and still air.

d. Dosage. Dosage is the total concentration (C) of war gas to which a man or animal is subjected, multiplied by the length of exposure (t).[2]

e. Hydrolysis. Hydrolysis is the reaction of a chemical substance with water to form new substances. Some war gases are thereby reduced in effectiveness, although if the resulting product is itself a poison (as with gases containing arsenic), further effort is required to make the product harmless. Some screening smokes are formed in air by hydrolysis.

f. Contamination. Contamination is the state of being covered, or act of covering something with chemical agents so that it is dangerous to touch.

g. Decontamination. Decontamination is the process of making any object or area safe for unprotected personnel by absorbing, destroying, or making harmless the war gases clinging to, or around it. *In general, only areas or materiel contaminated by persistent gases need be decontaminated*, since nonpersistent gases are quickly diluted to below dangerous concentrations.

h. Interdict. Interdict means to prevent or hinder the use of an area or route by the enemy by means of gunfire or chemical agents, or both.

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[2] Time, or t, is usually expressed in minutes (min). The Ct product is usually expressed in milligram minutes per cubic meter (mg min/m^3). Dosages may be *disabling* or *lethal.* A lethal dosage is the amount of war gas per given volume of air, necessary to kill an average unprotected man. Exact figures for both disabling and lethal dosages depend on the kind of gas and the weather conditions.

i. Gas casualty. A gas casualty is an individual who has been affected sufficiently by chemical agents to render him incapable of performing his military functions or duties.

j. Atmospheric stability. Atmospheric stability is a term describing air conditions. When there are many rising and falling air currents, the atmosphere is said to be unstable. When there are very few or none of these currents, the atmosphere is said to be stable. The rising and falling air currents are caused by thermal or mechanical turbulence.

k. Thermal turbulence. Thermal turbulences are atmospheric conditions resulting from thermal conditions *(inversion, neutral,* or *lapse)*. (See figure 5).

(1) *Inversion.* On clear nights with a steady but light wind, a condition exists in which there is an increase in temperature with increasing height above the ground. Air currents are at a minimum, and thus there are stable atmospheric conditions near the ground. This condition favors the use of nonpersistent gas. Inversion conditions tend to be destroyed in wind speeds exceeding 6 to 8 miles per hour over most types of terrain. Over very rough terrain, inversion conditions may be overcome by wind speeds lower than 6 to 8 miles per hour.

(2) *Neutral.* On heavily overcast days or overcast nights (and during the first hour after dawn and the hour before sunset), a condition exists in which there is very little or no change in temperature with height above the ground. There are

few extensive rising or falling air currents, and thus there are moderately stable atmospheric conditions near the ground. Neutral conditions are only moderately favorable for the use of nonpersistent casualty gas.

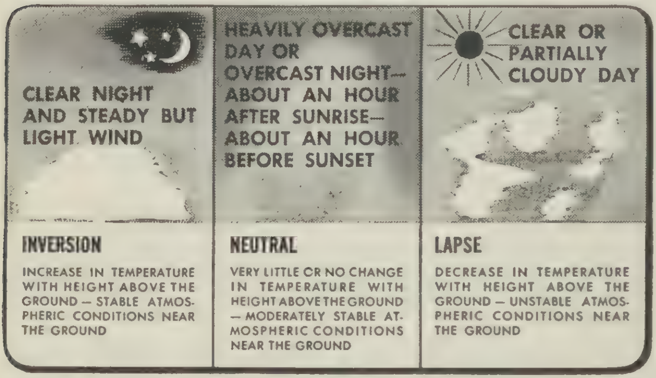

Figure 5. Degrees of atmospheric stability.

(3) *Lapse.* On clear or partially cloudy days, a condition exists in which there is a decrease in temperature with height above the ground. Air currents are at a maximum, and thus there are unstable atmospheric conditions near the ground. Lapse conditions may be modified in wind speeds over 12 miles per hour.

l. Mechanical turbulence. Mechanical turbulences are atmospheric conditions resulting from terrain conditions. When air moves over a surface, many small eddies result. The rougher the surface, the more eddies exist, and the more unstable the atmosphere becomes in the layers near the surface. (See figure 6.)

m. Chemical warfare symbols. Chemical warfare symbols are letters or combinations of letters designated by the War Department for convenience, to be used in place of full names of various chemical agents. These symbols are shown in figure 7.

16. CLASSIFICATIONS OF CHEMICAL AGENTS. Chemical agents are classified in four ways; by physical state, tactical use, physiological action, and persistency. These are explained in detail in figure 4.

17. DESCRIPTION OF CHEMICAL AGENTS. *Brief descriptions* of the more generally discussed chemical agents are tabulated in figure 7. The data are

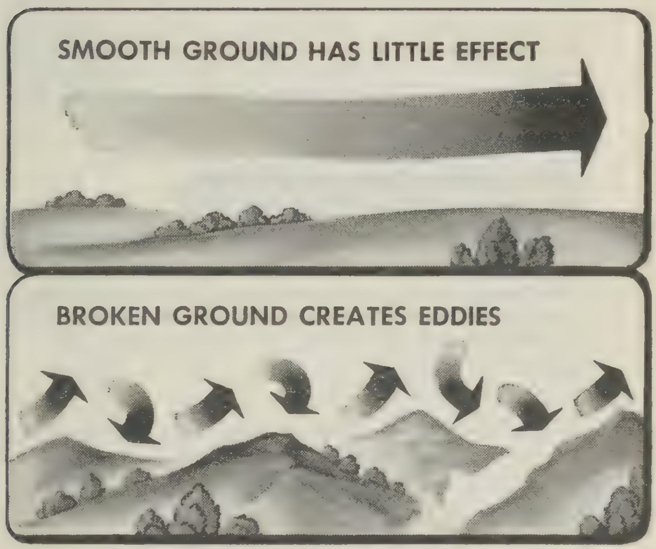

Figure 6. Rough terrain affects air currents.

BLISTER GASES

These are used for casualty effect (or threat of casualties) so that the use of ground may be restricted, movements slowed, supply impeded, and use of materiel or installations hampered. Physiologically, they injure eyes and lungs and blister the skin. Enemy blister gases may not smell like ours and may even be odorless. Detector devices, therefore, provide the most reliable warning. Enemy gases may also differ from ours in persistency; for example, there are several varieties of nitrogen mustards which make it possible to deny normal use of ground for a long or short time. Blister gases include:

PHYSICAL STATE	ODOR	PERSISTENCY
H (MUSTARD GAS)		
Normally dark brown liquid, changing slowly to colorless gas	Like garlic or horseradish when impure; odor of purified mustard gas (HT) sometimes faint	High in winter: 20 days or more, since it vaporizes slowly. Less in summer: sometimes only 1 day. Solidifies below 45° F.
HN* (NITROGEN MUSTARDS)		
Some are liquid at normal temperatures; others are slow-melting solids. Colorless to pale yellow	Faint to odorless; at strongest, like fish or soft soap	Volatility varies greatly. Least volatile may persist for weeks; others as short a time as 1 hour

*This is a "family" of war gases, like H in some ways. The nitrogen mustards are chemically related to each other but differ in physical state, odor, persistency, and effect

Figure 7. Description of chemical agents.

AGENTS — BLISTER GASES

PHYSICAL STATE	ODOR	PERSISTENCY
L (LEWISITE) Colorless liquid when pure, but usually dark brown, oily liquid. Evaporates as colorless gas	Odorless when pure; like geraniums when impure; always irritates nose and throat	Less than H, usually 1 to 7 days. Hydrolyzes in wet weather to lewisite oxide, a toxic, white solid that blisters skin after extended contact
ED Clear, somewhat oily liquid when pure, but usually brown liquid vaporizing as colorless gas. Slightly soluble in water	"Fruity" and irritating	Moderate; effective 1 to 12 hours, depending on weather, terrain, and concentration. Slow hydrolysis, forming poisonous product
MD Colorless liquid, vaporizing as colorless gas	Burning or irritating	Moderate; effective 1 to 12 hours, depending on weather, terrain, and concentration. Slow hydrolysis, forming poisonous product
PD Clear liquid	Irritating	Moderate; effective 1 to 12 hours, depending on weather, terrain, and concentration. Slow hydrolysis, forming poisonous product

NOTE: For names of chemical agents, see appendix IV.

Figure 7—Continued.

CHOKING GASES

These injure unprotected men, chiefly in the respiratory tract—that is, the nose, throat, and particularly the lungs. In extreme cases, membranes swell, lungs become filled with liquid, and death results from lack of oxygen; thus these gases "choke" an unprotected man. Chlorpicrin (PS) combines a choking with a tear and vomiting effect. The important choking gases are:

PHYSICAL STATE	ODOR	PERSISTENCY
CG (PHOSGENE)		
Clear liquid at low temperatures; gas in warm weather unless under pressure. White mist when released, turning colorless	Sweet in low concentrations; pungent (like freshly cut corn or new-mown hay) in high concentrations	Nonpersistent; is dissipated on high terrain in 10 minutes or less
PS		
Colorless, oily liquid. White gas when released, turning colorless	Sweet, like fly-paper	Moderate, 1 to 12 hours

Figure 7—Continued.

BLOOD AND NERVE POISONS

These are absorbed into the body, producing their effects by interference with respiration and other body functions. There are three principal gases in this category, namely:

PHYSICAL STATE	ODOR	PERSISTENCY
AC		
Clear, colorless liquid, changing to colorless gas	Faint odor, undetectable to some; like peach kernels or bitter almonds	Nonpersistent; lighter than air but a mixture of AC and air may be heavier than air at point of release
SA		
Colorless gas	Practically odorless when pure; otherwise garlic-like. (Metallic taste)	Nonpersistent
CK		
Colorless liquid, vaporizing on release to form colorless gas about twice as heavy as air	Practically odorless; sometimes biting. Stings skin, and brings strong flow of tears	Nonpersistent

NOTE: For names of chemical agents, see appendix IV.

Figure 7—Continued.

CHEMICAL

VOMITING GASES

These are normally solids, vaporizing when heated to form toxic smokes valuable for harassing; but when released indoors, they may cause serious illness or death. Under field conditions, vomiting gas causes the victim great discomfort, but effects wear off quickly. They may be used for mob and riot control. The three principal vomiting gases are:

PHYSICAL STATE	ODOR	PERSISTENCY
DM Yellow or green crystal solid in pure state, vaporizing when heated to form a yellow smoke	Practically odorless	Nonpersistent; lasts about 5 minutes at point of release
DA White solid in pure state, vaporizing under heat into fine white smoke	Practically odorless	Nonpersistent; lasts less than 10 minutes at point of release
DC Colorless crystal solid, vaporizing under heat into fine smoke	Resembles garlic or bitter almonds	Nonpersistent; lasts less than 10 minutes at point of release

Figure 7—Continued.

TEAR GASES

These are used for harassing purposes, producing tears and irritating the skin. Since there is small likelihood of tear gases producing casualties, they are used very little except for training and riot and mob control. The principal tear gases are:

PHYSICAL STATE	ODOR	PERSISTENCY
CN		
Solid (converted by heat into colorless gas), or a finely ground powder	Like apple blossoms	Persistent as solid; nonpersistent as gas
CNS		
Solid CN dissolved in mixture of chloroform and chlorpicrin. White gas when released, becoming colorless	Like apple blossoms	Summer: Up to 1 hour in open, 2 hours in woods Winter: Up to 6 hours in open, 1 week in woods
BBC		
Brown, oily liquid, evaporating into gas	Like sour fruit	Summer: Up to 3 days in open, 7 days in woods Winter: Up to 20 days

NOTE: For names of chemical agents, see appendix IV.

Figure 7—Continued.

SCREENING SMOKES

World War II made smoke important as both an offensive and defensive weapon, bringing into use many new methods of dispersing it. Screens are now used to conceal all types of troop movements and all types of installations, both in the combat zone and in rear areas.

Smoke consists either of finely divided solid particles (burning types of smokes) or of liquid droplets suspended in the atmosphere (such as the liquid smokes dispersed by airplane spray).

Smoke is injurious if very heavy concentrations are breathed for even a short time. (This is particularly true of HC.) Therefore, smoke should never be released indoors. The soldier wears a gas mask when:

- He feels unpleasant effects. (Some men are more sensitive to smoke than others. Since use of the mask decreases visibility even further, masks are not usually adjusted in friendly smoke except during prolonged exposure.)
- In a heavy concentration.
- Close downwind from source of smoke.
- Smoke is released indoors, where it develops a dense concentration.

Smoke may be used to camouflage war gases, particularly those of the nonpersistent type. Principal screening smokes are:

NOTE: For names of chemical agents, see appendix IV.

Figure 7—Continued.

AGENTS — SCREENING SMOKES

PHYSICAL STATE	MISCELLANEOUS
FS	
Liquid, hydrolyzing rapidly in air to form dense white smoke cloud	Generally used for airplane spray. Corrodes metal and injures fabrics
FM	
Liquid, hydrolyzing rapidly in air to form dense white cloud	Obscuring power slightly less than FS. Used in same way as FS
HC	
Solid; produces dense gray-white smoke when burned	Used in smoke pots, shell, and grenades; high obscuring power
WP (WHITE PHOSPHORUS)	
White or amber solid, igniting on exposure to air, making dense white smoke	Most obscuring of screening smokes; secondary uses as an incendiary and for casualty effect

SGF (FOG OIL)

This is used in mechanical smoke generators. One generator produces an aerosol by forcing a mixture of fog oil and water into a coil in a combustion chamber where heat vaporizes the two liquids. The vapor escapes into air where a rapid chilling condenses it into a white fog or aerosol

Figure 7—Continued.

INCENDIARIES

These ignite combustible material. They may also injure personnel. Combinations of incendiaries (or incendiaries and HE) are sometimes used. U. S. incendiary bombs are described in TM 9-1980. Common incendiaries are:

TH (THERMITE)

Normally used as igniter in magnesium bombs, also in large thermit bombs.

PHYSICAL PROPERTIES	BURNING	CONTROL
Intimate mixture of iron oxide, aluminum, and other materials	Normally used in small bombs. Aluminum reacts with iron oxide and generates high temperature (approximately 4,000° F.), producing molten iron. Burns with orange glow, quickly and violently	Resulting fires should be combatted: not the bomb itself

MAGNESIUM
No U.S. symbol

Used for bodies of small bombs, which are usually bound into clusters. Also used in powder form as ingredients of gel mixture for large incendiary bombs.

PHYSICAL PROPERTIES	BURNING	CONTROL
Metallic (solid or powder)	Magnesium case in 4-pound bomb burns 10 to 15 minutes at about 3,600° F. Has intense white glow and emits harmless white smoke	Burns faster when water is used but spatters under jet of water; resulting fragments quickly extinguished. Small bombs best extinguished by dropping in water

Figure 7—Continued.

AGENTS INCENDIARIES

WP (WHITE PHOSPHORUS)

Ignites readily flammable materials, especially dry vegetation. Very effective against personnel. Powerful psychological effect.

PHYSICAL PROPERTIES	BURNING	CONTROL
White or amber solid, igniting on exposure to air, making dense white smoke	Low burning temperature. Burns with bright yellow flame, giving off white smoke	Stops burning when flooded with water, but reignites when dry. Copper sulfate stops burning of small particles clinging to flesh

SR, CR, LA (OIL)

PHYSICAL PROPERTIES	BURNING	CONTROL
Gasoline with coconut oil and rubber thickener. Small pieces of metallic sodium sometimes added to insure functioning under moist conditions	Has yellow flame; emits dense black smoke	Should be attacked with any fire extinguisher except soda-acid or water types, or smothered with blankets, dirt, or sand. Water is used on resulting fires, but not directly on oil. Fog nozzle extinguisher is very effective

NP, IM (GASOLINE GELS)

Used in bombs, grenades, flame throwers, and fire bombs.

PHYSICAL PROPERTIES	BURNING	CONTROL
Thickened gasoline, often looking like rubber cement	Burns with great heat and yellow flame; produces black smoke	Smothering with earth is best control. Water also may be used

NOTE: For names of chemical agents, see appendix IV.

Figure 7—Continued.

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limited to characteristics important in field identification and concern chemical agents which were available to United States armed forces during World War II. They are not necessarily identical with possible enemy chemical agents, and some are not standard United States agents.

18. DETECTION AND IDENTIFICATION. The war gases may be detected without aid of special equipment by one or more of the following means; method of release, sensation, odor, and appearance. Generally speaking, chemical filled munitions have a much lower order of detonation than the same type munitions filled with HE. War gases, either in liquid or vapor form, may give a burning, biting, choking or prickly feeling in the nose, throat, lungs, or on the skin. Not all gases have characteristic odors, and the odors of the war gases that do have odors may be obscured by battlefield smells. Individual soldiers are taught to recognize physiological groups of gases (such as blister gases), and no attempt should be made to teach them recognition and identification of specific gases within these groups (such as CG in the choking gas group, or AC in the blood and nerve poisons group). The detonation gas identification set and the instructional gas identification set (sniff set) should be used only to give typical examples of war gas odors when these training aids are used in training the individual soldier. However, personnel whose duties call for more specialized training should learn how a specific chemical agent smells to them. Figure 7 includes the word description of the commonly accepted

odors associated with blister gases, choking gases, blood and nerve poisons, vomiting gases and tear gases. Figure 7 also includes a description of the appearance of chemical agents in the field. It has been said that war gases may be detected without special equipment. However, as an aid to positive identification of specific agents, for intelligence or other purposes, detection devices of various types have been developed and are issued to troops. These devices are discussed in detail in paragraphs 42, 43, and 44.

19. NEW CHEMICAL AGENTS. Research in the field of chemical warfare, by our own Government and the other governments of the world, can be expected to develop new chemical agents for use in war. As new chemical agents are developed in the United States and standardized for use by our forces, appropriate offensive and defensive doctrine will be established, and offensive and protective materiel will be adopted as soon as practicable. After the characteristics of new enemy chemical agents are received and evaluated, the field forces will be informed of these agents. Information for the field will stress detection, physiological characteristics, defensive measures and an evaluation of the protection afforded against these agents by the standard protective equipment issued to our forces. Changes to existing chemical warfare doctrine and new developments in offensive and defensive chemical warfare materiel made necessary by the development of new chemical agents, either foreign or domestic, will be announced in appropriate mediums.

CHAPTER 4
PHYSIOLOGICAL EFFECTS AND FIRST AID

20. GENERAL PRINCIPLES. The proper use of protective equipment, guards against injury by chemical agents; therefore, emphasis must be laid on the proper use and care of equipment in training. When soldiers are injured by chemical agents, self-aid and first-aid procedures become necessary. Specific first-aid procedures for specific chemical agents are shown in figure 8. These are meant for refreshing the knowledge of qualified gas personnel, a simplified set of self-aid procedures for the individual soldier is given in paragraphs 87 through 118. Treatment (which is a medical function) is discussed in TM 8–285. Detailed first-aid procedures are stated in FM 21–11. Omitting weather factors, the harmful effects of war gases on unprotected men depend to a large extent on—

a. The amount of gas in the air and the length of time men are exposed. In general, either long exposure to a low concentration or short exposure to a high concentration causes casualties. This rule does not apply to AC or CK, either of which is effective only in higher concentrations since the body detoxifies smaller amounts. Low concentrations, however, may be dangerous.

b. The reaction of the individual. Soldiers show varying sensitivity to a given gas, especially blister gas.

21. DISPOSITION OF EXPOSED PERSONNEL. The disposition of exposed personnel is a command function. Considering the tactical situation, the severity of exposure, and the medical officer's

recommendation, the unit commander decides whether to continue exposed men in action. Evacuation is seldom necessary in nonpersistent gas attacks if masks have been adjusted, since these gases are diluted to less than dangerous concentrations within short periods. The immediate mission may demand that remedial procedures be delayed.

22. BLISTER GASES. The effects on the body of the war gases of the blister gas group and the first-aid measures for each appear in figure 8. As a group, blister gases have many characteristics in common, both with respect to their effects on the body and the first-aid procedures taken to cope with them. The war gases of the blister gas group, in general:

a. Have the following effects on the body. (1) Either in liquid or vapor form, they burn and blister any area of the body they contact.

(2) They are extremely effective, even in the smallest quantities. A drop the size of a pinhead may produce a blister the size of a quarter. An unprotected man exposed 1 hour to a few parts of vapor per million parts of air can become a casualty.

(3) They have a marked effect on the eyes.

(4) They are quickly absorbed by the skin.

(5) They are insidious. The effects of mustard gas and nitrogen mustard can appear without warning. Exposure to these gases may go unnoticed, since they have faint odors and cause no immediate pain. Signs of injury may not appear

BLISTER GASES

EYES	**PHYSIOLOGICAL EFFECTS** **H**: Vapors cause no immediate symptoms: even liquids are only mildly irritating at first. In a few hours, eyes become inflamed, smart, water, feel gritty, and are sensitive to light. Lids swell. In severe cases, there is great pain, tears, and yellow discharge—permanent damage may result. **HN**: Generally the same as H, but damage from more volatile forms of HN is more severe.
RESPIRATORY AND DIGESTIVE SYSTEMS	**PHYSIOLOGICAL EFFECTS** **Respiratory system**: Vapors inflame throat and windpipe if contaminated air is breathed. Mouth becomes dry, throat burns, and harsh, distressing cough develops. Partial loss of voice is common. Pneumonia may develop in severe cases. **Digestive system**: Nausea and vomiting may follow severe skin contamination, especially in hot weather, even if mask has been worn. This is a systemic effect, not due to direct injury; swallowing of contaminated saliva, food, or drink may cause pain, vomiting, and inflammation of the stomach.
SKIN	**PHYSIOLOGICAL EFFECTS** **H**: Injury begins with reddening, like sunburn, and may be followed by blistering. (Under different climatic conditions, this varies with concentration and length of exposure.) *Liquid* always blisters unless counteracting steps are taken at once. Moist skin areas are most affected (like bend of elbows and knees, armpits, and crotch). **HN**: *Vapor* hazard highly variable. *Liquid* forms blisters more quickly, but they are less severe.

FIGURE 8.—*First-aid procedures for specific chemical agents.*

FIRST AID

Apply BAL eye ointment, squeezing ointment into eye and massaging gently. (If eyes cannot be opened, work BAL between lids.) Then flush with water, pulling on lower lid with one hand and pouring water from container held in other hand. Continue washing ½ to 2 minutes. Roll eye about while washing. First aid must be completed before mask is donned. If BAL is not available, flush eye with water alone.

FIRST AID

Same for both respiratory and digestive tracts. Immediately remove liquid gas from face to prevent further inhalation of vapors. Also remove contaminated clothing. No other first aid is effective. Victim is handled like choking gas casualty: loosen clothes, keep quiet and warm, give warm (non-alcoholic) drink, and evacuate by litter.

FIRST AID

H: *Liquid* must be removed and skin decontaminated within 3 minutes (½ to 1 minute if skin is hot and moist), but decontamination within 15 minutes may prevent or lessen blistering and systemic effects. Remove contaminated clothing, then pinch-blot skin with cloth furnished with protective ointment, or with another cloth. Be careful not to contaminate additional skin. Next, squeeze ointment from tube, rubbing it on affected area for 30 seconds. Wipe off excess. Repeat and leave ointment on skin. Soap and water can be used as substitute, or bleach paste (equal quantities of water and dry bleach) can be used if washed off within 3 minutes. Do not use either ointment or bleach if skin has already reddened or begun to blister unless liquid is present; it only increases the burn. Instead, use calamine lotion (item 2 in gas casualty first aid kit), following instructions in kit, if kit is available.

HN: Wash contaminated areas with large quantities of soap and water, or water alone. If these are not available, use ointment as outlined above for H. Ointment merely dilutes HN, however, and does not destroy it.

Vapor contamination cannot be helped by first aid, since damage is already done.

(Note: If blisters develop from either H or HN burns, try to prevent them from breaking until medical treatment is available. Secondary infection may result from broken blisters.)

FIGURE 8.—*Continued.*

EYES	**PHYSIOLOGICAL EFFECTS** **L**: Eyes are especially susceptible. *Vapor* irritates immediately; *liquid* causes instant, excruciating pain and spasm of eyelids. Unless first aid measures are taken immediately, eyes swell and inflame seriously within 1 hour, and may be permanently injured. **ED, MD, PD**: Same as L, but generally less severe.
RESPIRATORY AND DIGESTIVE SYSTEMS	**PHYSIOLOGICAL EFFECTS** **L**: Highly irritating (unlike H) but effects similar to H. **ED, MD, PD**: Same as H, generally, but breathing very low vapor concentrations may cause coughing, sneezing, pain in nose and throat, nausea and vomiting, and distressed feeling.
SKIN	**PHYSIOLOGICAL EFFECTS** Same as H, but *liquid* acts faster, penetrating skin rapidly and causing stinging sensation within 10 to 30 seconds; pain increases as L penetrates. Gray area, like acid burn, apparent after 5 minutes. Skin reddens after 30 minutes, as with H, but is more painful. Risk from field concentrations of *vapor* is small. Irritant vapors force masking.

FIGURE 8.—*Continued.*

FIRST AID

Apply BAL eye ointment, squeezing it into eye and massaging gently. If eyes cannot be opened (L is immediately painful in eyes), work ointment between lids. Then flush with water, pulling on lower lid with one hand and pouring water from container held in other hand. Continue washing ½ to 2 minutes. Roll eye about while washing. First aid must be completed before mask is donned. If BAL is not available, flush eye with water alone.

FIRST AID

ED, MD, PD: Generally the same as for H, but after exposure to low vapor concentrations (producing symptoms like those of vomiting gas), rinse nose and throat with water, and keep patient quiet. Use eye and nose drops (item 4 in gas casualty first aid kit) if kit is available.

FIRST AID

Pinch-blot liquid from skin immediately. If skin hurts, gas may be assumed to be an arsenical. Apply protective ointment as described for H contamination (although it may not completely prevent blistering if weather is hot). Use soap and water if nothing else is available. Try to prevent blisters from breaking until medical treatment is available. *Vapor* contamination cannot be helped by first aid.

(NOTE: When gas casualty first aid kit is available, BAL eye ointment from the kit may be used on the skin. But the individual soldier's small tube of BAL eye ointment is used *only* for contaminated eyes.)

FIGURE 8.—*Continued.*

CHOKING GASES

PHOSGENE

PHYSIOLOGICAL EFFECTS

Symptoms vary considerably, but there is usually irritation of nose and throat, coughing, difficulty in breathing, and pain in chest, especially upon deep inhalation. Other possible symptoms are tears, vomiting, sweating, easy fatigue, and blueness of lips and ear lobes. Symptoms appear immediately only if exposure has been severe. They may persist and grow worse but often first symptoms disappear, followed by latent period in which victim feels fairly well. More serious symptoms of lung injury may not appear for several hours.

BLOOD AND NERVE POISONS

HYDROCYANIC ACID OR CYANOGEN CHLORIDE

PHYSIOLOGICAL EFFECTS

Highly toxic when inhaled. *High concentration* is fatal. *Low concentration* may produce headache, dizziness, and nausea. AC stimulates breathing. By contrast, CK may make breathing difficult, is highly irritating, and brings copious tears. *Liquid* penetrates the skin and is toxic.

ARSINE

PHYSIOLOGICAL EFFECTS

Mild cases cause lassitude, headache, and uneasiness. *Increased exposure* causes chills, nausea, and vomiting. *Severe exposure* damages blood, causing anemia; urine is brown or red. Effects are delayed.

FIGURE 8.—*Continued.*

(CG)

FIRST AID

Keep mask adjusted until area is free of gas. Soldier should carry on if there are no immediate symptoms. But if there are immediate symptoms, institute first aid as soon as tactically possible. Loosen clothing, have soldier rest, and keep him warm with blankets. Do *not* give artificial respiration unless victim has stopped breathing. Offer nonalcoholic, stimulating drinks (hot tea or coffee). Evacuate to aid station by litter as soon as possible. Greatest danger for choking gas victims is during first 48 hours after exposure.

(AC, CK, AND SA)

FIRST AID

If victim is in a closed place, mask him and move into fresh air immediately; too great a concentration may penetrate the gas mask canister. *If he has stopped breathing,* give artificial respiration until medical aid is available. Use amyl nitrite (item 7 of gas casualty first aid kit) meanwhile. Crush and hold close to victim's nose or thrust inside facepiece if masked. Repeat at 3- to 5-minute intervals, meanwhile continuing artificial respiration. *If liquid gets on skin,* wash with water or a weak solution of baking soda and water. Remove clothes containing liquid, and let them air.

FIRST AID

Adjust mask and remove victim by litter to fresh air. Do not let him walk. Hospitalize immediately.

FIGURE 8.—*Continued.*

VOMITING GASES

PHYSIOLOGICAL EFFECTS

Irritate nose and throat, often causing coughing, sneezing, and salivation. Pain in nose, throat, and windpipe is fairly intense; gums and teeth ache. Nausea and vomiting may occur, and victim may feel very distressed. There is little danger, however, and effects usually pass within 3 hours. Most victims can carry on strenuous duties without harm, and often with a more rapid decrease in symptoms.

TEAR GASES

PHYSIOLOGICAL EFFECTS

Produce acute pain in eyes, profuse tears, and spasm of eyelids. There is usually no permanent damage, and effects wear off quickly; but temporarily the victim may find it almost impossible to see.

INCENDIARIES

PHYSIOLOGICAL EFFECTS

White phosphorus burns are discussed under screening smokes. Other incendiaries cause ordinary burns.

FIGURE 8.—*Continued.*

(DM, DA, AND DC)

FIRST AID

Keep mask adjusted as long as gas is present in atmosphere, pulling it away from chin only briefly during periods of actual vomiting. Remove, shake, and air outer clothing if situation permits. Wash skin with soap and water. If symptoms persist, rinse nose and throat with water. In extreme cases, keep victim quiet until distressing symptoms have passed, and have him inhale fumes of chloroform (item 1 in gas casualty first aid kit), if kit is available. Repeat inhalations as required.

(CN, CNS, AND CNB)

FIRST AID

Do not rub eyes; this only increases the irritation. Keep mask adjusted until atmosphere is free of gas, then remove it and face into wind with eyes open. Skin areas which sting or burn, or on which liquid gas has been splashed, should be washed with soap and water. If liquid has entered eyes, flush them with plenty of water, or use eye and nose drops (item 4 in gas casualty first aid kit). Medical treatment is not ordinarily needed, nor is evacuation normally necessary.

(TH, MAGNESIUM, WP, OILS, GELS)

FIRST AID

If skin is broken, cover raw area with first aid dressing. For more serious burns, give victim first aid for shock, keep quiet and warm, and evacuate as soon as possible. For WP burns, see screening smokes.

FIGURE 8.—*Continued.*

SCREENING SMOKES

LIQUID SMOKES (FS, FM)

PHYSIOLOGICAL EFFECTS

Liquids irritate or burn skin. Smoke itself is usually harmless except in prolonged exposure; slightly irritating to respiratory tract.

SOLID SMOKE (HC)

PHYSIOLOGICAL EFFECTS

Prolonged exposure without mask irritates nose and throat; may cause coughing and lung irritation. Concentrations indoors or near site of dispersion are dangerous.

WHITE PHOSPHORUS (WP)

PHYSIOLOGICAL EFFECTS

Smoke is harmless except in prolonged exposure, but it irritates the nose and throat. Burning particles cause severe burns.

Figure 8.—*Continued.*

FIRST AID

Wash liquid from body with water (preferably soapy). If respiratory tract is irritated by smoke, move to fresh air when tactically possible.

FIRST AID

Remove victim to fresh air if tactically possible. Severe cases should be hospitalized and treated for pneumonia and pulmonary edema, if present.

FIRST AID

Douse the burn with canteen water, and wet the copper sulfate pad with water. Press the wet pad directly on the WP particles and squeeze liquid on burned area. Carefully pick coated particles from skin. Discard pad: do not use as a dressing after particles are removed. Use copper sulfate solution from gas casualty first aid kit, if available. CAUTION: Do not use grease, oils, or ointments; phosphorus poisoning may result.

FIGURE 8.—*Continued.*

for 2 to 6 hours. (Lewisite vapor irritates the eyes and respiratory tract immediately, however, and *liquid* lewisite stings the skin within a few seconds.)

b. Require first aid measures (in the following sequence): (1) Decontaminate eyes. (Use BAL in M5 kit.)

(2) Decontaminate hands.

(3) Decontaminate face, neck, and ears.

(4) Adjust mask.

(5) Cut away contaminated portions of clothing—ordinary or protective; or entirely remove garments if badly contaminated. Decontaminate skin areas underneath contaminated portions of clothing.

Note. Vapor burns to skin, eyes, or respiratory tract cannot be decontaminated successfully. The damage has been done by the time the symptoms appear.

23. CHOKING GASES. The effects of typical choking gases on the body and first-aid procedures appear in figure 8. Troops exposed to a choking gas need not be withdrawn during combat unless signs of pulmonary distress are apparent.

24. BLOOD AND NERVE POISONS. The effects on the body and first-aid for the more important blood and nerve poisons is also shown in figure 8. These gases produce their effect after absorption into the body. In high concentrations, an unmasked man may take in enough AC in a few breaths to cause immediate death.

25. VOMITING GASES. The effects in the body and first-aid for vomiting gases is outlined in

figure 8. Vomiting gases are used for harassing purposes, and may be employed to cover the use of a lethal gas. Personnel must be warned that the distress following exposure to vomiting gases may increase after the mask is put on. The mask must be left in place, nevertheless, although it should be pulled away from the chin (not removed) during actual vomiting attacks. The facepiece must be cleared of gas after each breaking of the gas-tight seal.

26. TEAR GASES. First-aid for tear gases is shown in figure 8.

27. INCENDIARIES. First aid for incendiaries is also shown in figure 8. The procedure for white phosphorus burns is shown with screening smokes. (See figure 8.) The soldier carries a copper sulfate pad for coping with white phosphorus burns.

28. SCREENING SMOKES. First-aid for screening smokes is shown in figure 8. Smokes should never be released indoors, since the high concentrations (and carbon monoxide from burning types of munitions) developed in confined spaces may result in injury. Concentrations formed at the site of dispersion are also dangerous.

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CHAPTER 5
USE AND BEHAVIOR OF CHEMICAL AGENTS

29. TACTICAL PURPOSES. Although specific details of enemy tactics cannot be foreseen, reasons for using chemicals in combat can be stated. Ability to recognize the immediate tactical reason for such use may aid the commander in planning his defense. Figure 9 lists possible munitions in which one or another of the groups of chemical agents may be used. The purposes for the tactical employment of chemical agents other than smokes and incendiaries by our own and by enemy forces, are discussed below. Smoke and incendiaries are discussed in paragraphs 34 and 35. In general, war gases are used, in—

a. Casualty attacks. These are surprise attacks in which high concentration of war gases are built up in a short space of time (2 minutes or less) on an area occupied by personnel to obtain a maximum number of casualties. Surprise is essential, since trained and well-disciplined troops minimize the results of such attacks. Usually nonpersistent agents are employed although persistent agents may be used.

b. Harassing attacks. These are prolonged attacks in which a concentration of war gas vapor is maintained in a specified area to force troops to wear gas-masks and to take other protective measures. Nonpersistent war gases may be used. However, it is more likely that persistent agents will be used because of the economy of munitions and the

added inconvenience, delay, and danger due to contamination.

c. Neutralization attacks. These attacks employ persistent agents in counter-battery fire, and to force troops to evacuate areas or abandon materiel, to interdict strategic points by utilization of chemical barriers or to make supplies unusable. A determined enemy may elect to remain in contaminated areas or to cross chemical barriers basing his decision upon certain calculated risks.

30. EMPLOYMENT OF CHEMICAL AGENTS. The characteristics and field behavior of each group of chemical agents dictate when and how the group probably will be used in field operations. Figure 4 classifies these groups according to tactical employment. It is not possible to anticipate accurately when and how the enemy will use chemical attack. A knowledge of when and under what conditions chemical agents can be most effectively used by the enemy, however, generally enables commanders to anticipate chemical attack.

31. NONPERSISTENT WAR GASES. Nonpersistent war gases (figure 7) are normally used on large groups of personnel to kill or disable. These gases are generally placed on targets very quickly and in high concentrations so that large percentages of troops are exposed to casualty-producing dosages before they have time to mask. Gases such as CK may be laid down in heavy concentrations over long periods of time for the purpose of penetrating gas mask canisters. Nonpersistent war gas is more likely to be used offensively than defen-

POSSIBLE MUNITIONS FOR CHEMICAL AGENTS

CHEMICAL AGENT	MUNITIONS										
	CANDLE OR POT	FLAME THROWER	ARTILLERY SHELL	MORTAR SHELL	ROCKET	AIRPLANE SPRAY	BOMB	GRENADE	LAND MINE	PRESSURE SPRAY	SMOKE GENERATOR
BLISTER GASES			✓	✓	✓	✓	✓		✓	✓	
CHOKING GASES		✓	✓	✓	✓	✓	✓				
BLOOD AND NERVE POISONS		✓	✓	✓	✓		✓	✓			
VOMITING GASES	✓							✓			
TEAR GASES	✓		✓	✓		✓	✓	✓			
SCREENING SMOKES	✓		✓	✓	✓	✓	✓	✓			✓
INCENDIARIES		✓	✓	✓	✓		✓	✓			

NOTE: This list is not meant to be exhaustive, nor is it meant to include only standard United States fillings.

Figure 9. Miscellaneous chemical munitions.

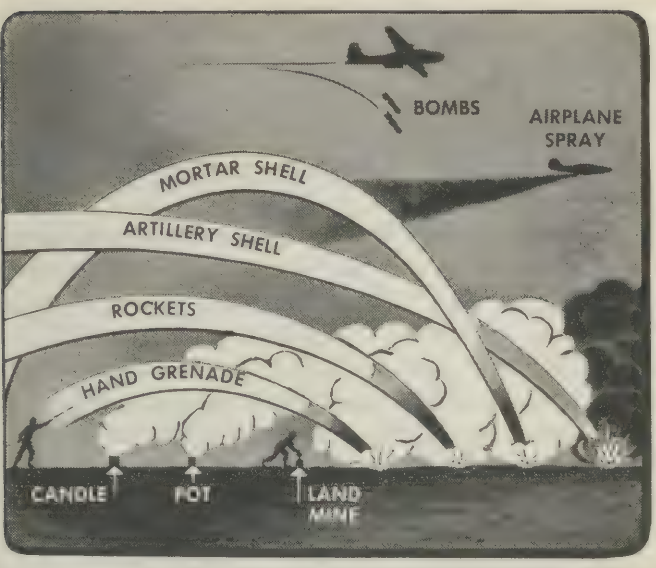


Figure 10. How war gas may be released.

sively because troops on the defensive are more likely to remain static. Weather conditions which are in general most favorable for the use of nonpersistent war gases consist of wind speeds below 12 miles per hour and inversion conditions. (See paragraph 15k.) Wind speeds of approximately 5 miles per hour are most favorable. These gases are not likely to be used in heavy rains. Heavily wooded terrain is more favorable for the use of nonpersistent war gases than open areas, although some of the gas is absorbed by the foliage. Concentrations attained in woods or jungle may be three times higher than those in the open. Concentrations of nonpersistent war gas are higher

in valleys and depressions than on hills and slopes. Thus, canister-penetrating dosages of nonpersistent gases such as CK may be encountered in low places or in heavy woods. For a detailed discussion of the effect of weather on nonpersistent war gases, see TM 3–240.

a. Use by ground forces. Nonpersistent war gases may be fired from mortars, artillery, or rockets. (See figure 10.) If troops are within the range of these weapons, there is danger of suffering nonpersistent war gas attacks. Strong points may be attacked with nonpersistent casualty gas-filled grenades. Nonpersistent casualty gas laid down by ground force munitions is influenced to a greater extent by weather than nonpersistent casualty gas laid down by air force munitions. Thus, in wind speeds over 10 miles per hour or under lapse conditions (paragraph 15k), nonpersistent casualty gas attack by air is likely to be more effective than the same type of attack by ground weapons.

b. Use by air forces. Nonpersistent war gas may be dropped from the air in large bombs. (See figure 10.) This type of attack is especially dangerous because large quantities of gas can be released in very short periods of time. Air chemical attack is not limited to combat areas, and are likely to be launched against strategically important targets. In nonpersistent gas attacks laid down by air bombs the sudden expansion of a large quantity of agent to form a cloud produces a cooling of the surrounding atmosphere to form an artificial "inversion" condition. Hence, non-

persistent gas attacks by air drop are not affected by weather to the same degree as those in which ground chemical munitions are employed.

32. PERSISTENT WAR GASES. Persistent casualty gases (figure 7) are used against troop concentrations for casualty effect or on materiel and terrain targets to restrict use through threat of casualties. Most blister gases can be used for producing casualties through liquid contact or through exposure to vapor. Persistent casualty gases may be effectively used both offensively and defensively. There are more possibilities, however, for defensive use. Persistent casualty gas is most effectively used in hot, humid climates because the body is much more sensitive to these gases under such conditions. Persistent casualty gases may be used in wind speeds up to 15 to 20 miles per hour, but higher wind speeds do not necessarily preclude the use of these gases. Inversion conditions are most favorable for the use of persistent casualty gases, and high vapor dosages may be expected under inversion conditions. Ground temperature is an important factor in determining how long a persistent casualty gas persists and how fast effective vapor dosages are attained (that is, the higher the ground temperature, the shorter the persistency and the faster effective dosages are attained.) Heavy rains are unfavorable to persistent gas attacks. It can be very effectively used, however, during light rains or immediately after heavy rains. For a detailed discussion of the effect of weather on persistent casualty gases, see TM 3-240. Contaminated vege-

tation is more hazardous than contaminated bare ground. Persistent casualty gases, therefore, are more likely to be used on vegetated targets. Thick woods and jungle are excellent persistent casualty gas targets, and very high vapor dosages may be attained on such targets. Thick jungle or forest canopy is a good cover from airplane spray; therefore, spray attacks are not likely to be made on heavily wooded or jungle targets, but bomb attacks set up high vapor dosages in such areas.

a. Use by ground forces. Persistent casualty gases may be fired from mortars, artillery, generators, or rockets. (See figure 10.) Areas or materiel can be contaminated by land mines filled with these gases. Land mines are also used to contaminate demolitions to slow down clearance and repair. Blister gases may be used in grenades and in various types of booby traps. Targets within the range of any of these weapons may be objects of persistent casualty gas attacks.

b. Use by air forces. Persistent casualty gases may be released from airplanes in large or small burster type bombs, light case bursterless bombs which rupture by force of impact, or as spray from spray tanks. (See figure 10.) When long persistency is desired, the light case bursterless bombs which yield a heavy contamination around the point of impact are usually used. Spray is essentially used directly against personnel. Because of its short persistency, it will rarely be used on terrain targets. Burster type bombs may be used either against personnel or on terrain. High vapor dosages are attained more quickly

when persistent casualty gases are laid down by burster type bombs or spray.

33. HARASSING GASES. These are used to handicap troops in carrying out missions by forcing them to wear masks or take gas-protective measures. Tear or vomiting gases (figure 7), or light concentrations of nonpersistent or persistent casualty gases can be used for this purpose. Harassing attacks are usually made against troop concentrations. Tear gases may be dispersed from mortar or artillery shell, tear gas pots, grenades, bombs, or sprayed from spray tanks. (See figure 10.) Irritant smokes are usually dispersed from candles or pots.

34. SMOKES. Smoke screens and blankets (figure 7) are used to hinder observation and thus to hamper operations, reduce effectiveness of fire (including bombing), or reduce ability to meet an attack. In addition to its smoke effect, WP may be used for casualty effect. Smoke may be used in conjunction with casualty gas attack to conceal the presence of the casualty gas. Smoke can be expected to be used under almost any weather condition. It is most likely to be used in wind speeds under 15 to 20 miles per hour.

a. Use by ground forces. Smoke can be laid with mortar or artillery shell, smoke pots, and mechanical smoke generators. (See figure 11.)

b. Use by air forces. Air forces can lay smoke by using bombs or by spraying. (See figure 11.) Thus, observation points located beyond the range of

ground weapons, as well as antiaircraft weapons, can be objectives of smoke missions.

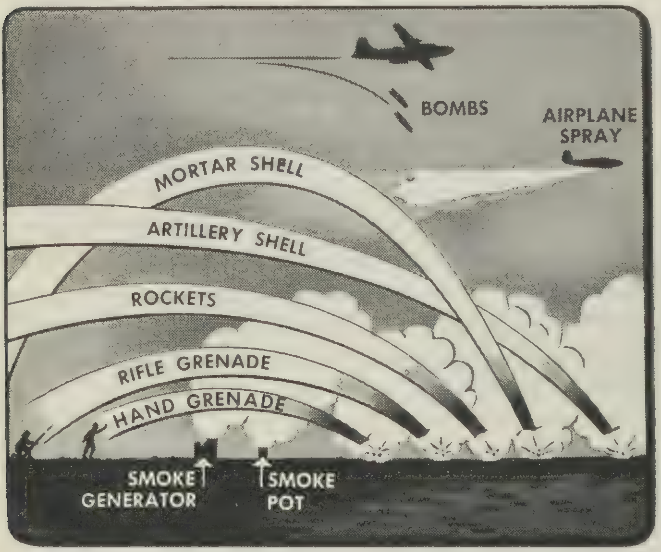


Figure 11. How screening smokes may be released.

35. INCENDIARIES. These are used primarily to destroy flammable supplies, but they may be used to kill, disable, or demoralize personnel, and for defoliation of camouflaged installations. (See figure 7.) The use of incendiaries is not controlled appreciably by weather conditions. In very high winds, however, use of flame throwers may be impractical. Fires started by incendiaries in high winds tend to spread rapidly and are usually difficult to extinguish.

a. Use by ground forces. Ground forces use flame throwers, which have proved very effective against

personnel. (See figure 12.) In addition, incendiary grenades are available to ground forces and are used for the purpose of igniting flammable materials. Incendiary grenades are often used to destroy materiel which must be abandoned. Gasoline or flammable oil may be poured from bulk containers into fortifications, such as caves or dugouts, and then ignited.

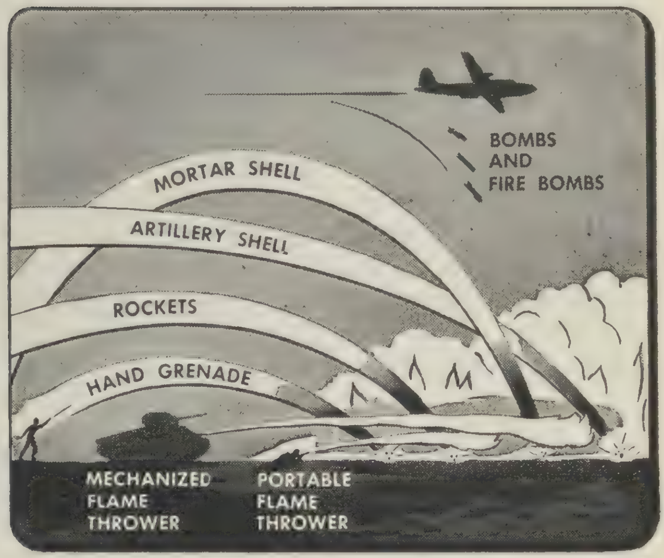


Figure 12. How incendiaries may be released.

b. Use by air forces. Incendiary bombs of various sizes and types may be dropped on tactically or strategically important flammable installations. (See figure 12.) These bombs may be of a type which burn at extremely high temperatures and

are difficult to extinguish. Highly flammable liquids in thin-cased containers may be dropped on troop concentrations and field fortifications and ignited.

36. REFERENCES. For the general effects of weather and terrain on chemical agents, see TM 3–240. For principles guiding the offensive use of chemical agents, see FM 3–5 and 3–6.

CHAPTER 6
INDIVIDUAL PROTECTION

37. GENERAL. Defense against chemical attack begins with individual defensive measures and progresses to collective and tactical defensive measures. Both individual and collective protection involve principally the provision and use of protective equipment and installations. The responsible commander and his assistants should use this chapter in conjunction with paragraphs 87 through 118 for an over-all view of the subject.

38. COMMAND RESPONSIBILITIES. The unit commander is responsible for training his command in individual protection, for inspections of training and equipment, and for decisions as to the employment of collective protective measures in operations. Within this framework, it is the individual soldier's duty to protect himself against chemical attack.

39. TRAINING OF THE INDIVIDUAL SOLDIER. The equipment and technique to be used by the individual soldier for his own defense are explained in paragraphs 87 through 118, followed by outlines for his training. During the progress of training, the unit commander makes frequent inspections both of the training methods employed and of the care and state of the soldier's protective equipment. Particular attention must be paid to the proper fit of gas masks and to the proper adjustment of protective clothing.

40. EQUIPMENT AND TECHNIQUES. a. General. Since paragraphs 87 through 118 are addressed to the individual soldier and the contents are meant to be learned by him, details necessarily omitted there are discussed here.

b. Gas masks. For complete details regarding gas masks, see TM 3–205.

(1) Instruction in proper fitting and adjustment of the mask is a command responsibility which cannot be delegated to noncommissioned officers. Facepieces must fit the wearers to secure a comfortable gastight seal. Slight variations occur in facepiece manufacture, and these may mean the difference between a good and a bad fit. The universal facepiece comes in three sizes: SU (small universal), U (universal), and LU (large universal). These should be tried until a proper fit is obtained.

(2) It is recommended that where practicable the facepiece fit be determined by a 3- to 4-hour wearing test, during which time the gas chamber test can be conducted.

(3) Some masks are equipped with a nosecup, which is meant to reduce the tendency of lenses to fog or frost. If the nosecup exerts uncomfortable pressure on the nose bridge, another mask should be substituted. If substitution does not solve the difficulty, the nosecup should be altered by slitting. (See TM 3–205.) Such repair work should be supervised by the unit gas officer.

(4) Gas masks should be stored in a dry place and not subjected to extremes of temperature.

(5) The service canister effectively protects

against the effects of all standard war gases in field concentrations. Since the canister does not supply oxygen it does not afford protection in inclosed spaces where the oxygen content of the air may be too low to sustain life or where concentrations of toxic gases are too high. The service canister does not afford protection against industrial gases, such as ammonia, nor against carbon monoxide. Special canisters are provided for protection against these gases and are described in TM 3–205.

(6) Gas personnel repair or supervise the emergency repair of gas masks within their own and lower units. They have available the *kit, repair, gas mask, company, M2A1* and the *tool set, repair, gas mask, universal, M8,* which is issued to regiments and separate battalions. Gas mask repair is discussed in TM 3–205.

c. Protective clothing. Protective clothing is clothing which has been impregnated with certain chemicals to afford protection against blister gas vapor and very small droplets when the clothing is worn as prescribed. This clothing is described in TM 3–290.

(1) Special attention must be given to the adjustment of protective clothing including the hood. Necessary precautions are outlined in paragraph 95.

(2) Troops must be given practice in the wearing of protective clothing, especially in tropical climates, in order to increase tolerance to discomfort.

(3) Under conditions of high humidity and tem-

perature, the working capacity of troops dressed in protective clothing is decreased. To avoid heat prostration and undue fatigue, rest periods should be frequent.

(4) Protective clothing should be stored in a cool, dry, well-ventilated place. Impermeable protective clothing should not be folded in storage, since creases tend to break the material.

(5) Protective clothing is tested for its protective value either in the field or at laundry installations. The kit, testing, impregnite in clothing, M1 is used for this purpose. Directions for making the tests are given in TM 3–290. In the field, such tests may be made by the unit gas officer. At laundry installations, they are made by personnel trained in the work.

(6) Procedures for putting on and taking off protective clothing are given in TM 3–290. Contaminated clothing is placed in gas resistant sacks and sent immediately to a quartermaster laundry for decontamination.

(7) A field impregnating set may be used for emergency impregnation.

CHAPTER 7
COLLECTIVE PROTECTION

Section I. INTRODUCTION

41. SCOPE. a. General. Collective defense against chemical attack includes equipment, installations, and techniques used by the unit or by smaller groups for defense of personnel, materiel, and animals against chemicals. It includes:

(1) Detection devices.

(2) Alarm systems and duties of sentinels.

(3) Gasproof shelters and fortifications.

(4) Protection of supplies and equipment.

(5) Decontamination of food and water.

(6) Decontamination of equipment, terrain, and buildings.

(7) Personnel decontamination stations.

(8) Organizational first aid.

(9) Defense against incendiary attack.

b. Training of teams. Although the techniques required in some of the factors listed above are discussed in paragraphs 93 through 98, when such activities as decontamination and incendiary control are organized, they become collective defense measures. Individuals should be trained so that in emergencies they can function as members of teams, especially in large-scale decontamination.

c. Supply. The flow of supplies is shown in figure 34.

Section II. DETECTION DEVICES

42. GENERAL PRINCIPLES. Various detection devices (figure 13) have been designed for both the detection and identification of war gases. These

Figure 13. Detection devices.

devices indicate the presence of war gas by a change of color. They are useful in indicating the completeness of decontamination, in determining the presence of war gas in concentrations too low to be detected otherwise, and in estimating the hazard of operations in contaminated areas.
The following paragraphs are limited to fundamentals.

43. DESCRIPTION AND USE. **a. Liquid vesicant detector paint.** Detector paint is effective only for *spray* or *droplets,* not for *vapor.* It is olive green, turning red when in contact with blister gases. Bleach, M4 decontaminating agent, protective ointment, and certain tear gas solutions give the paint a similar red color. The paint turns brick red at temperatures over 150° F. The paint is applied to fenders and hoods of vehicles on areas visible to the driver, or to other organizational equipment, and must be renewed frequently.

b. Liquid vesicant detector paper. Detector paper is issued in booklets of 25 sheets. It is heavy paper coated with detector paint, which turns red when liquid blister gas touches it. It has certain field limitations. Like detector paint, it is affected by bleach and other materials even in the absence of war gas. *It does not detect vapor.* Heat, steam, or oil decrease its sensitivity, and it turns red when heated to approximately 150° F. It is unreliable in determining completeness of decontamination.

c. Vesicant detector crayon. These crayons detect contamination under conditions where detector paint fails. They are rubbed on surfaces, or particles are shaved off with a knife blade to pro-

duce a powder. Detector crayon turns from red to blue in the presence of blister gases (with the exception of the nitrogen mustards) in liquid or in high vapor concentrations. It also changes color in the presence of phosgene and other gases, and in the presence of strong acids, such as hydrochloric or sulfuric. It is unreliable in testing completeness of decontamination since it is affected by free chlorine.

d. Chemical agent detector kit. (1) The detector kit reveals dangerous concentrations of certain war gases by color changes in tubes through which contaminated air is drawn and to which liquid reagents are added. Complete directions for use are included with each kit. (Directions also appear in TM 3–290.) All unit gas personnel and all special gas sentinels should be thoroughly familiar with the use of the kit, and the kit should be used whenever practicable or when any doubt exists.

(2) The sensitivity of the detector tubes makes it possible to determine whether the air contains a dangerous amount of gas. In interpreting the results obtained by sampling air or vapors, personnel must be certain that samples are taken at several points, at frequent intervals, and in accordance with wind conditions.

(3) If a large enough sample of contaminated air is taken, the detector tubes are sufficiently sensitive to detect a concentration below that necessary to cause casualties. Low concentrations of phosgene which are detectable by smell, however, are not detected by the kit.

44. NEED FOR DETECTION DEVICES. Personnel should be impressed with the fact that the senses alone are not to be trusted in the detection of war gases. War gases smell different to different individuals. Battle odors often mask war gas odors. Odors may be faint or undetectable. Reaction products formed during decontamination may strongly resemble the odor of the original blister gas and yet be harmless. Mustard gas made by the Levinstein process contains a large proportion of inactive impurities which resemble mustard gas in odor but evaporate much more slowly. Since these are harmless, an area contaminated with Levinstein mustard gas retains a characteristic odor long after the danger has passed. Hence, the best guide is a series of tests with the detector kit, or a knowledge of when the area was contaminated, together with an understanding of the effects of weather on war gases. Taking unnecessary gas precautions is to be avoided, but a relaxation of precautions before the danger is gone is hazardous. Detection devices may be used to verify conclusions drawn from the table in appendix I, which shows the time which must elapse before it is possible to perform certain tasks in a contaminated area without danger.

Section III. ALARM SYSTEMS AND DUTIES OF SENTINELS

45. ALARMS. The two types of local alarms given by the sentry or individual when he detects gas are prescribed in paragraph 105. General alarms are sent out if large areas are involved. Such

alarms are given by all normal methods of communication and embrace all areas likely to be affected. The procedure should be set forth in the unit standing operating procedure.

46. DUTIES OF SENTINELS. All sentinels have chemical defense duties, which are explained in paragraphs 104 through 106. Depending upon the tactical situation, special gas sentinels may be required for installations such as gasproof shelters, for protection of materiel, and for guarding contaminated areas. These should be detailed as required. Duties of gasproof shelter sentinels are described in paragraph 51.

47. SPECIAL GAS SENTINELS. Special gas sentinels are usually posted to warn troops against dangerous gassed areas and to protect supplies at distributing points. Their duties do not differ from the usual gas duties of sentinels except that they are given special instructions regarding specific duties. Special sentinels on duty where supplies are stored should have protective clothing. Such installations may be subject to frequent spray attacks. Since such attacks develop rapidly, the sentinel must be on the alert in order to get the supply covers into position. Covers should fold and be adaptable to quick spreading in case of attack. They should always be in position when practicable. (See paragraphs 52, 53, and 54.) If the attack is by incendiaries, the sentinel should give the prescribed fire alarm.

Section IV. GASPROOF SHELTERS AND FORTIFICATIONS

48. PURPOSE AND TYPES. a. Purpose. Since it is possible for an enemy attack to subject an extensive area to lethal concentrations of casualty war gas for periods ranging up to several days, some means of shelter must be provided for various types of field activities. Masks and protective clothing are sufficient protection against such concentrations, but they cannot be worn indefinitely, moreover, many essential functions cannot be performed satisfactorily while wearing such equipment. Gasproof shelters are needed, therefore, where troops can rest and eat during prolonged attacks, and where communications, command, and similar functions can be conducted without interruption. Field hospitals may also require gasproofing. Full particulars concerning shelters and collective protectors used with them are given in TM 3-350 and FM 5-15. Essential details are given below.

b. Types. If gasproof shelters are equipped with collective protectors (TM 3-350), they are the ventilated type. If not, they are called unventilated. Each shelter is posted with a sign giving this information, together with the capacity and length of time the shelter can be occupied. Either ventilated or unventilated shelters may be permanent, semipermanent, or improvised. Permanent and semipermanent gasproof shelters are built by the Corps of Engineers according to approved drawings. Improvised shelters, either ventilated or unventilated, are built in the field when the

need arises. This section is concerned only with the field type of improvised shelter, which is usually built from structures or dugouts already in existence or easily and quickly constructed.

49. LOCATION AND DESIGN. No standard procedure can be outlined for designing improvised shelters in the field. Such factors as time, location, and availability of materials necessarily influence any plans. The following fundamental considerations, however, apply to any gasproof shelter project.

a. Location and capacity (figure 14.) (1) Shelters should be accessible to the personnel using them.

(2) The number of persons expected to use the shelter should be determined in advance and accommodations provided accordingly. The capacity of each shelter should be posted in a conspicuous place at its entrance and upon an interior wall.

(3) Ventilation must be provided for shelters expected to be occupied either by active or inactive personnel for extended periods during gas attacks.

(4) Shelters should provide protection against both chemical agents and high explosive. An emergency exit and an airlock entrance should be provided.

(5) Such local weather factors as air currents and prevailing winds should be studied so that the shelter is not located where high concentrations of war gas may be encountered.

(6) Both terrain and earth texture should be studied in choosing a location. Well-drained, firm soil is generally found on hillsides.

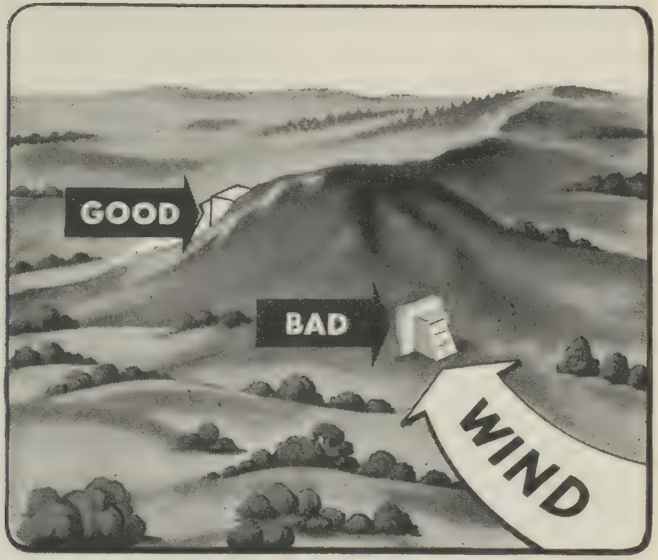


Figure 14. Location of a gasproof shelter. Arrows show direction of prevailing winds.

(7) The shelter should be camouflaged as well as possible. It should be underground if terrain and other factors permit.

b. Design. The following fundamentals are offered as a guide:

(1) Elimination of drafts and prevention of gas seepage are basic considerations.

(2) If underground, the shelter should be covered with several feet of earth or sandbags. If above ground, all joints and cracks must be sealed. Floors should be made as nearly gastight as possible.

(3) Pipes and conduits should be sealed at the point of exit. Ventilators and chimneys should

be stopped up, or altered so that they can be closed.

(4) Windows should be protected against blast effect by sandbagging, or by other methods. Gasproof curtains should be available to replace broken windows.

(5) An emergency exit should be provided.

50. CONSTRUCTION (for details, see TM 3–350.)

a. Entrances. Entrances should be walled-in passageways fitted with double doors, or gasproof curtains, about 9 to 12 feet apart. The double doors create an airlock to reduce gas seepage into the shelter. Slanting frames are built for gasproof curtains, and the curtains are weighted to hold them in place. Two entrances may be desirable.

b. Ventilated shelters. A separate room should be selected for collective protector equipment. This equipment supplies positive pressure in the sheltered space, keeping war gases out. The outside air inlet leading to the collective protector should be placed as high as practicable to avoid gas concentrations near the ground.

c. Existing structures. If existing structures are converted to gasproof shelters, care should be taken to seal all possible leaks, such as cracks, fireplaces, ventilators, and window frames. Airlocks can be improvised in hallways leading to doors. Doors should be made to fit gastight.

d. Miscellaneous factors. (1) Seats, lights, water, and toilets should be provided.

(2) Such safety facilities as decontamination

materials, tools, and repair materials should be stored in the shelter.

(3) Smoke tests should be made frequently during unoccupied periods to determine leaks. (See TM 3–350.)

(4) The chemical agent detector kit should be provided for frequent tests within the shelter during gas attacks.

e. Capacity. For inactive personnel, 1 cubic foot of air per minute per man in unventilated shelters must be provided. Ventilated shelters should be provided for active personnel, who require about 5 cubic feet of air per minute. Capacity of the shelter is governed by size of the collective protector system. The following table suggests dimensions for unventilated shelters occupied by up to 50 men, the practicable maximum:

Number of occupants	3-hour air requirements (cu ft)	Suggested dimensions (feet)		
		Length	Width	Height
1	180	7	4	7
15	2,700	22	15	9
30	5,400	30	19	10
50	9,000	35	24	11

51. OPERATION. a. Sentinels. A sentinel is provided for each gasproof shelter. His duties are shown in figure 15. In unventilated shelters, the sentinel must also warn occupants to limit their physical exertion and not to smoke.

b. Entering. The shelter is entered through the airlock after personnel (figure 15) have used the

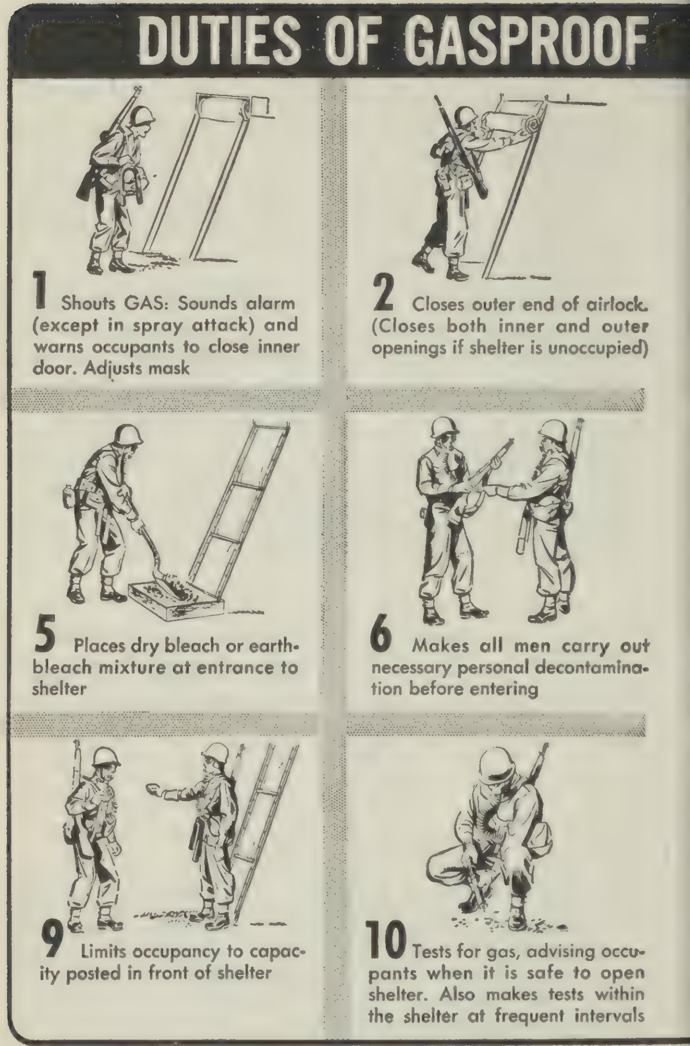
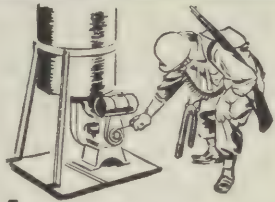


Figure 15. Duties of a gasproof shelter sentinel.

SHELTER SENTINEL

3 Makes certain all fires in shelter are extinguished and that all openings are closed



4 If shelter is ventilated, starts collective protector

7 Makes certain that personnel entering shelter open curtain properly on downwind side

8 Opens door or raises curtain for litter bearers

11 Ventilates shelter after attack and prepares it for use again

shuffle box outside. Heavily contaminated clothing or equipment is removed before entering the airlock. Clothing and equipment, only lightly contaminated, may be left in the airlock. If the entrance is closed with gasproof curtains, personnel enter on the downwind side of the entrance, the curtain being opened only enough to permit passage.

c. Restrictions on occupants. Personnel should restrict their movements to a minimum in unventilated shelters and should not smoke. No fires should be permitted since they consume oxygen and create drafts which may bring in war gas.

d. Tests. Gasproof shelter sentinels should be trained in the operation of shelters, collective protectors, and detector devices. During gas attacks, they should make frequent tests within the protected space for dangerous concentrations of war gases. They also should be alert for the exhaustion of collective protector canisters and leakages in the shelter.

e. Ventilation. Gasproof shelters should be thoroughly ventilated after every gas attack. Shelters equipped with collective protectors can be aired by opening all doors and windows and running the collective protector.

Section V. PROTECTION OF SUPPLIES AND EQUIPMENT

52. GENERAL PRINCIPLES. Chemical agents may damage supplies not adequately protected both as a result of the original contamination and through acids formed by the hydrolysis of certain war gases.

PROTECTIVE PACKAGING

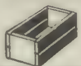
TYPE OF PACKAGE	PROTECTION AGAINST VAPORS	PROTECTION AGAINST LIQUIDS
 Sealed metal drums	Complete	Complete
 Sealed, metal-lined cases or casks	Complete	Complete
 Sealed cans	Complete	Complete
 Bottles or glazed vessels with well-fitting stoppers of impervious materials	Complete	Complete
 Sealed wooden barrels, such as those used for liquids	Complete	Complete, except in heavy, prolonged contamination
 Multilayer paper bags (asphalt binders, cellophane plies)	Good	Good
 Bottles or glazed vessels with ordinary cork stoppers	Good	Fairly good
 Cans with well-fitting lids, but not sealed	Fairly good	Good
 Metal foil or cellophane	Good if unbroken and all joints tight	Good if unbroken and all joints tight
 Wooden boxes or thick cardboard	Good if all joints tight	Poor; very absorbent
 Paper containers, sacks, or canvas	Poor	None

Figure 16. Protective packaging.

Moreover, supplies contaminated with blister gases are dangerous for personnel to handle or contact. Proper packaging and storing minimize the effects of chemical agents. Effectiveness of the various packaging materials is shown in figure 16. Paulins or other covers are used over supplies stored outdoors. Paulins, used in pairs with a layer of tree branches between them, provide increased resistance to penetration of liquid agents.

53. PROTECTIVE PROCEDURES. a. Food. When possible, bulk food items are kept in closed containers (preferably moistureproof) and covered with paulins. The most vulnerable foods are placed in the least exposed positions. For protection against airplane spray, kitchen trucks are covered with paulins, and field kitchens are provided with tent flies or other overhead covers. Contaminated food is usually discarded, but instructions of the medical officer govern its disposal.

b. Water. Water is kept in closed containers. If Lister bags are used, they may be protected from liquid contamination by individual protective covers adapted to this purpose. The Medical Corps reports on the potability of water, and the Corps of Engineers purifies it.

c. Equipment. (1) *Ammunition.* Ammunition is kept in its containers as long as possible.

(2) *Weapons.* Weapons are covered with protective paulins or dispersed under natural cover.

(3) *Instruments.* Instruments such as those used for fire control, are kept in their containers when not being used. Both ammunition and instru-

ments are subject to corrosion by such war gases as phosgene and such smokes as FS.

(4) *Airplanes.* Airplanes are provided with covers (at least for cockpits, plastic windows, guns, and gun compartments) when not in hangars.

(5) *Automotive equipment.* Automotive equipment is stored in woods free of underbrush, but lower portions of ravines and canyons are avoided. (Mobility of vehicles provides some degree of tactical protection.)

(6) *Flammable supplies.* Flammable supplies such as fuel, oil, and flammable munitions, are kept in containers until used.

54. GASPROOF SUPPLY SHELTERS. Occasionally it may be safer and more convenient to store supplies in gasproof shelters. Unventilated shelters with airlocks usually provide sufficient protection, but supplies especially susceptible to moisture should be kept in shelters equipped with collective protectors.

Section VI. DECONTAMINATION OF FOOD AND WATER

55. GENERAL. a. Preliminary procedures. Water, food, and forage may become contaminated by toxic chemicals in spite of efforts to protect them. (See figure 17 for effects of chemical agents on food and water.) Blister gases and blood and nerve poisons are the most likely contaminating agents. Special methods of analysis are required to determine purity of water, and purification of water should be attempted only as a last resort. Transportation of water may be required. Food sus-

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EFFECT OF CHEMICAL AGENTS

	FOOD	WATER
	BLISTER GASES	
H	Liquid and heavy vapor poison; give bad taste and odor; quickly absorbed by fatty or oily foods; discolors meat	Liquid and heavy vapor poison; liquid forms oily film; acid is formed on hydrolysis; impure H has intense odor and yellowish color
HN	Liquid and heavy vapor poison; characteristic HN odor may be absent; does not discolor food	Liquid and heavy vapor poison; during hydrolysis, acid and poisonous substances are formed; slight taste and odor
L	Liquid and heavy vapor poison; may discolor food, particularly meat and vegetables	Liquid and heavy vapor poison; on hydrolysis, form L-oxide and acid; may give acid taste; impure L imparts characteristic odor
MD	Same as L, but less pronounced	Same as L
ED	Same as L, but less pronounced	Same as L
PD	Same as L, but less pronounced	Same as L
	CHOKING GASES	
CG	Liquid and vapor give bad taste; not dangerous after aeration, except in fatty foods	Liquid and vapor hydrolyze rapidly, giving disagreeable acid taste; not dangerous
PS	Liquid and vapor give bad taste and odor; aeration purifies foods of low water and fat content	Gives biting, peppery taste; not dangerous
	BLOOD AND NERVE POISONS	
CK	Liquid and vapor poison, especially oily and fatty foods	Liquid and vapor poison; give bitter taste
AC	No effect from vapor, except possibly on fatty or oily foods; liquid gives temporary odor of AC, soon dissipated by aeration	Same as CK
SA	Liquid and vapor have little effect, except possibly on fatty or oily foods	Liquid and vapor poison; give characteristic odor

Figure 17. Effect of chemical agents on food and water.

ON FOOD AND WATER*

	FOOD	WATER
	VOMITING GASES	
DM	Solid particles poison food; heavy vapors dangerous	Solid particles and heavy vapors poison; make water cloudy and cause brownish color
DA	Same as DM	Solid particles and heavy vapors poison; make water cloudy
DC	Same as DM	Same as DA
	TEAR GASES	
CN	Solid particles give bad taste and odor	Solid particles and heavy vapors give biting, peppery taste; acid formed on hydrolysis; water becomes undesirable for drinking
CNS	Liquid gives bad taste and odor	Same as CN
BBC	Same as CNS	Same as CN
	SCREENING SMOKES	
FS	Liquid gives acid taste; high concentration of smoke gives bad odor. Not toxic	Forms acid, making water undesirable for drinking
FM	Liquid gives slightly acid taste; smoke harmless. Neither is toxic	Gives acid taste; makes water cloudy and undesirable for drinking
HC	No appreciable effect. Not toxic	Makes water cloudy, brackish, and undesirable for drinking
WP	Solid particles burn dry food; fatty, oily foods may absorb poisonous amounts; smoke harmless	Smoke dissolves to form acid; water becomes undesirable for drinking
	INCENDIARIES	
	Burn on direct contact; smoke causes disagreeable taste and odor	Smoke causes bad taste and odor, making water undesirable for drinking

*For action of chemical agents on metals, see TM 3-215

pected of being contaminated should not be prepared for consumption until proper inspection is made by authorized personnel. Large quantities of food should not be condemned until the possibility of decontamination is determined. Prompt segregation of heavily contaminated portions may prevent contamination of the remainder.

b. Responsibilities. The Medical Corps (sanitary officer) determines the purity of water supplies. The decision for disposal of food and forage is a function of the Medical Corps and Veterinary Corps. Suspected contamination is reported at once to the unit commander who immediately establishes the necessary safeguards. See TM 8–285 for directions.

56. SPECIFIC RECLAMATION PROCEDURES. For a detailed discussion of food, forage, and water contamination, see TM 5–295 and 8–285 (appendixes VI and VII).

a. Water. Purification of water should be undertaken only by trained personnel. Detailed procedures are given in TM 5–295 and 8–285.

b. Food. Food items should be divided into three groups for separate treatment as outlined below. (See figure 16 for evaluation of the effectiveness of packaging and the seriousness of contamination.)

(1) *Group I: Packaged items exposed only to vapor.* Air sufficiently to remove clinging vapors.

(2) *Group II: Packaged items contaminated on the outside with liquid agent.* Strip off outer wrapping layers until an uncontaminated wrapping is

reached (use detector crayon). Place in group I if an uncontaminated wrapper is reached. If penetration to food has occurred, place in group III.

Warning: Attempts to decontaminate packaging materials may spread the contamination. Canned goods can be decontaminated by bleach or DANC, followed by washing in water. C rations should be boiled for 1 hour in the cans.

(3) *Group III: Unpackaged or poorly packaged items exposed to liquid or vapor or both.* In general, it is not practicable to salvage foods heavily contaminated with drops of blister gases (especially the arsenicals). If decontamination is feasible, the following procedure should be followed in order. Trim off surface fat and grossly contaminated areas, wash with water or 2 percent solution of sodium bicarbonate, and boil in water. (Boiling may be eliminated when contamination is from choking gas or tear gas vapors. If such exposure has been light, aeration may suffice.) Frying, roasting, or broiling will not remove traces of blister gases from meats. Further details (by groups of war gases) are given below.

c. Miscellaneous procedures. (1) Choking gases offer relatively little danger to food. They decompose rapidly (with the exception of chlorpiorin) and form products which alter the taste. Washing, followed by aeration, is sufficient except for chlorpiorin, which is soluble in fat.

(2) Liquid H or liquid HN renders foods of high water or fat content unfit for consumption. When contamination is from vapors, wash in soda solution (as in group III above), rinse in clear water,

and cook intensively. Dry provisions can be aerated until a negative test is given with the chemical agent detector kit.

(3) Arsenical blister gases hydrolyze to form poisonous arsenical oxides. Discard foods contaminated with those agents.

(4) AC in high concentrations may render food with high water content unfit for consumption. Arsine, carbon monoxide, and *low concentrations* of AC have little effect on food. If any doubt exists, food exposed to AC should be discarded. Foods exposed to CK must be discarded.

(5) Forage and grain lightly contaminated or exposed to vapor should be aerated and tested with the chemical agent detector kit. Supplies so treated, and mixed with larger amounts of uncontaminated supplies, produce no ill effects on animals. If forage is heavily contaminated with liquid blister gas (especially the arsenicals), it should be discarded.

(6) Screening smokes alter the taste of food but do little damage otherwise. Unburned particles of WP are poisonous, and foods containing such particles should be discarded. Liquid FS may render foods unfit for consumption. Liquid FM can be washed from foods.

Section VII. DECONTAMINATION OF EQUIPMENT, TERRAIN, AND BUILDINGS

57. REFERENCES. Decontamination performed by the individual soldier on his person and personal equipment is outlined in paragraphs 101, 102, and 103. Descriptions of materials. equipment, and

procedures given below are limited to essentials. Principal decontaminating materials and the method of their application are shown in figure 18. For more detailed descriptions of apparatus and procedures, see TM 3–220, 3–221, 3–222, 3–223, 3–228, and 5–295.

58. DECONTAMINATION APPARATUS AND MATERIALS. **a. One and one-half-quart apparatus.** This looks like an ordinary hand-operated fire extinguisher. Decontaminating agent M4 (DANC) is the only approved filling. In gas warfare it is carried in each motor vehicle, and normally in airplanes carrying gas-filled bombs or spray tanks. It is used for prompt decontamination of small but important items or surfaces.

b. Three-gallon apparatus. This is a hand-operated tank-type sprayer equipped with an air pump. It has a discharge hose with valve and nozzle and is used to spray contaminated equipment with DANC, gasoline, or kerosene. To operate, close and lock the top, operate the pump 20 to 25 strokes, and press the valve lever. Pump additional air as needed. The apparatus is used for decontaminating materiel.

c. Power-driven apparatus. This is a 400-gallon apparatus mounted on a 2½-ton truck. It is assigned only to special personnel and is used for large scale operations, such as decontaminating roads, buildings, and other critical installations. It is filled with wet mix (bleach slurry), or with water and detergent (such as soap), delivering about 20 gallons of slurry, or 30 to 35 gallons of water per minute.

DECONTAMINATING AGENTS

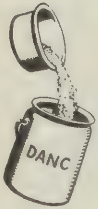
BLEACH (CHLORIDE OF LIME)

HOW USED: Either in pure form, as dry mix (2 parts bleach to 3 parts earth), or wet mix (slurry; 1 pail water to 6 shovelfuls bleach). If possible, leave on surface 24 hours. One pound bleach makes enough slurry to cover 1 square yard of average contamination.

ACTION: Reacts with blister gas liquid to form non-vesicant compound, but pure form in direct contact with pools of liquid mustard gas reacts violently to cause flame and heavy vapor. Generally used as dry mix or wet mix. Is chemically active, causing vigorous corrosion.

STORAGE: Keep in tightly closed container, away from moisture.

DECONTAMINATING AGENT M4 (DANC)



HOW USED: Mix powder and solvent; apply solution with small decontaminating apparatus or with swabs. Remove residue in a few hours. Directions for mixing are on container.

ACTION: Neutralizes blister gases. Generally less injurious than bleach to leather, fabrics, and metal, but corrodes metal and damages most paints, rubber, and plastics unless removed promptly.

CAUTION: Solvent (acetylene tetrachloride) is sufficiently toxic both in vapor and liquid form as to require care in handling. Effects are cumulative.

WASHING SODA (SODIUM CARBONATE)

HOW USED: Add 1 pound of soda to 10 gallons of very hot water; stir rapidly; apply hot to contaminated surfaces.

ACTION: Destroys blister gases, but much slower than bleach, DANC, or caustic soda.

Figure 18. Decontaminating agents and how they are used.

AND HOW THEY ARE USED

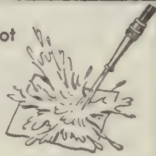
CAUSTIC SODA (LYE)

HOW USED: Caustic soda is used in solution with water. Especially effective for destroying lewisite. Decontamination faster with concentrated solutions.

ACTION: Destroys blister gases, but does not destroy mustard gas as rapidly as bleach.

CAUTION: Both solid and solution damage skin, eyes, and clothing. Do not use for personal decontamination. Caustic soda corrodes surfaces.

WATER OR STEAM



HOW USED: Apply under high pressure; action of hot water is speeded if soap or other detergent is used.

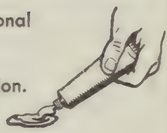
ACTION: Removes dirt or grease containing gas.

FUELS AND SOLVENTS

HOW USED: Spray fuel on contaminated surface and ignite; solvent (like gasoline, kerosene, or oil) is applied with swabs. Do not spread contamination.

ACTION: Ignited fuel destroys gas by burning; solvents merely *dilute* gas, but if diluted enough, most contamination disappears. Residues remain dangerous.

PROTECTIVE OINTMENT



HOW USED: By individual soldier for limited personal decontamination (chap. 9).

ACTION: Neutralizes blister gas by chemical action. Normally requires 15-minute contact, except on skin.

d. Decontaminating agents. These are shown in figure 18. Others include:

(1) *Bleach paste.* Add enough bleach to water to make a smooth paste; apply paste with brushes or swabs.

(2) *Sun and air.* In warm weather, the sun and air decontaminate after a sufficient time. Textile fabrics contaminated with vapor are decontaminated in bright weather in 2 or 3 days. In dull weather, this method may take longer.

(3) *Earth.* If the area is to be used, it may be covered with a layer of earth. A 3-inch cover of earth (if not disturbed) seals over a gassed area but does not destroy blister gas. (If the covering is undisturbed for several weeks at temperate conditions, the blister gas is finally destroyed.)

(4) *Protective ointment.* Protective ointment, M5, is primarily for use in personnel decontamination in self-aid measures (paragraph 100); and may be used for emergency decontamination of personal equipment. (See paragraph 102.) In addition to its use as a decontaminate, protective ointment may also be used as a blister gas burn preventive when applied in sufficient quantity to leave a visible film on the skin. As a preventive apply the ointment prior to entering the area suspected of being contaminated. *Protective ointment must not be placed in or about the eyes.*

(5) *Burning.* Contaminated vegetation may be burned, but liquid which has soaked into the ground remains dangerous.

59. PROCEDURES. For more details on decontamination, see TM 3–220.

Caution: The procedures outlined below are not applicable to decontamination of food and water. (See paragraphs 55 and 56.)

a. For blister gases in general. The object is to remove the threat of both liquid and vapor by destroying the gas. Intimate contact between gas and decontaminant is necessary for rapid decontamination.

(1) Either dry bleach alone or dry mix (2 shovelfuls of bleach to 3 shovelfuls of dry earth) may be used to destroy blister gases. Pure bleach reacts violently with pools of liquid blister gas. Care must be used when decontaminating by this method, since heavy vapor concentrations are given off.

(2) Wet mix (slurry) is made in two ways: It is a 50–50 mixture of bleach and water by weight (for every 6 shovelfuls of bleach add a 14-quart bucket of water) when used for spreading by brooms or swabs; or it is mixed 40 percent bleach and 60 percent water by weight (twenty-six 50-pound cans of bleach (1,300 pounds) to 225 gallons of water) when used in the 400-gallon decontaminating apparatus. Wet mix should remain on the surface being decontaminated for from 6 to 24 hours, if possible.

(3) Water used by itself hydrolyzes blister gases too slowly for practicable decontamination. It may be used to wash blister gases away mechanically if there is adequate drainage. Special decontaminating personnel with proper equip-

ment may use other means, such as water, soap, and other detergents. (A solution of 3 pounds of soap shavings and 3 pounds of washing soda to 100 gallons of water may be used.) Blister gas sinks to the bottom of pools of water, and care should be taken not to come in contact with the washings.

(4) DANC is an effective decontaminant. It is usually used in the decontaminating apparatus. The solvent alone (acetylene tetrachloride) may be used to wash away blister gases, but the washings remain dangerous.

(5) Burning the area or object is a quick way of decontaminating, but tactical considerations may prohibit fires in the field.

(6) After decontaminating measures have been completed, any item likely to be handled by personnel must be tested with detector paper or the detector kit to ascertain that decontamination is complete. (It should be remembered that paper detects only liquid agents.) In all decontamination, wear gas masks and protective clothing, including impermeable protective gloves, if available.

b. For HN. Water or soap and water are the most practicable agents for field decontamination of the nitrogen mustards. Hot water is more effective than cold water, but both merely wash the gas away mechanically, and adequate drainage is required to protect personnel.

c. For L and other arsenicals (MD, PD, ED). DANC or bleach is best. Water is only partially effective. Since water may leave a vesicant solid if it is

used for decontamination, the surface should be treated with a caustic solution, such as washing soda or lye.

d. For other gases. PS and CN are moderately persistent. PS persists about 3 hours under average conditions. Aeration is usually sufficient. A hot solution of sodium carbonate (washing soda) neutralizes solid CN.

e. For rubber articles. DANC should not be used for rubber articles, such as boots and gloves. Several days' aeration in sun and wind suffices if contamination is light. Soaking several hours in water just below the boiling point, or immersion 24 hours in a mixture of 1 part bleach to 2 parts water (by volume) followed by rinsing and several days' aeration, is better for heavy contamination.

f. For ammunition. Wipe off visible contamination with rags. Apply DANC, wipe with gasoline-soaked rag, then dry. If DANC is not available, scrub with soap and cool water. If ammunition is corroded, clean it thoroughly or destroy it. Wet mix (slurry) can be used on contaminated ammunition containers, but it must not be allowed to penetrate to the ammunition itself.

g. For instruments. If exposed to corrosive gases, clean as soon as possible with alcohol (or gasoline, if no alcohol is available), and apply a thin coat of light machine oil. A rag dampened with DANC may also be used, followed by drying with a clean rag and application of machine oil. (DANC injures plastic or hard rubber surfaces.) Delicate

instruments are decontaminated by special processes by higher echelons.

h. For weapons. Remove dirt, dust, grease, and oil. Do not apply wet mix, but allow surfaces to aerate after soil and dirt have been removed. DANC can be used on all metal surfaces except the bore. Hot water and soap, or repeated applications with gasoline-soaked swabs, are also effective, and protective ointment can be used for emergency decontamination of small arms as outlined in paragraph 102. After decontamination, weapons are dried and oiled.

i. For airplanes. (1) In flight, the crew of a contaminated airplane must perform sufficient decontamination to continue the mission. Masks and protective clothing should be worn. Vital interior parts, such as seats, instrument board, controls, and firing apparatus, are decontaminated immediately by blotting excess contamination with a rag, then using DANC. It must be remembered, however, that DANC roughens painted and rubber surfaces, and is harmful to plastics. Water is used to decontaminate painted surfaces free from grease and oil, but soap and water may be used more effectively. Bleach paste may be applied to rubber parts. Blister gas sprayed on wings and fuselage loses its *vapor* danger after flights of 1 to 1½ hours, but prolonged contact with the contaminated part must be avoided. Masks may be removed after this period, but tests for gas within the interior of the airplane should be made prior to removal. Hot air from the airplane engine heater may be used to decontaminate the interior of the airplane.

(2) Only soap and water should be used on plastic surfaces since protective ointment etches these substances.

(3) If leaking munitions are the cause of contamination, they should be dropped from the airplane.

(4) Complete decontamination of the airplane is performed by special troops after the airplane has landed. (See TM 3–220 for further details.)

j. For automotive equipment. Light contamination from spray can be decontaminated by aeration alone. For heavier contamination, use DANC on interior and exterior surfaces which personnel are likely to touch. For larger area decontamination, wash vehicle with water and scrub painted surfaces with soap and water. In emergencies when vehicle is being used, decontaminate hood and front parts only. In decontaminating vehicles. begin on upwind side, upper parts first.

k. For terrain. (1) Burning the area destroys gross surface contamination (except where there are pools of liquid blister gas) and destroys vegetation holding drops of liquid. Burning does not destroy liquid blister gases which have soaked into the ground; therefore, lying on ground thus treated should be avoided. *When burning contaminated areas of grass or brush, great care must be exercised to determine that no friendly troops are within the danger area downwind, and if the area to be burned over is large, additional protective measures must be taken.*

(2) Dry bleach, dry mix, or wet mix are satisfactory for decontamination of terrain containing

very little vegetation, but these decontaminating agents must be camouflaged either by covering with earth after spreading or by the addition of camouflage materials (dark earth) before using. The amount of bleach to be used is approximately 1 to 2 pounds per square yard. Hard road surfaces can be flushed with water under high pressure, or dry bleach can be spread from a bleach spreader. Large flat areas can also be decontaminated by using the bleach spreader to spread dry bleach. Containers of dry bleach may be detonated by use of a suitable explosive to obtain coverage of approximately 1 square yard of surface per 1 pound of bleach. Dry mix and wet mix are usually used only for localized areas because of the excessive labor involved.

(3) When decontamination is not practical or necessary, post all approaches to the area with gas warnings, standard or improvised, showing type of gas and date of contamination or discovery. Post signs far enough away to give ample warning. (A sample gas warning sign is shown in figure 19.)

l. For buildings. Scrubbing with wet mix is the quickest method of decontaminating. Wet mix may be applied from the 400-gallon power-driven apparatus. It is mixed 40 percent by weight of bleach to 60 percent by weight of water (or 225 gallons of water to twenty-six 50-lb. cans of bleach. This method is especially useful for high vertical surfaces. Wet mix should remain on the surface for 6 to 24 hours before being washed away. Paste may also be used; it is scrubbed into

the wood with swabs or brushes. If the surface is smooth, the outside may be washed with water and the washings neutralized with bleach. If the building is not needed, burn it or leave it to decontaminate by aeration after posting suitable warning signs.

m. For textile fabrics. The method employed for decontamination of textile fabrics should be governed by the degree of contamination, the decontaminants available, and the type of textile fabric. The following methods may be employed:

(1) For vapor contamination, textile fabrics may be aerated in sunlight for 2 to 3 days.

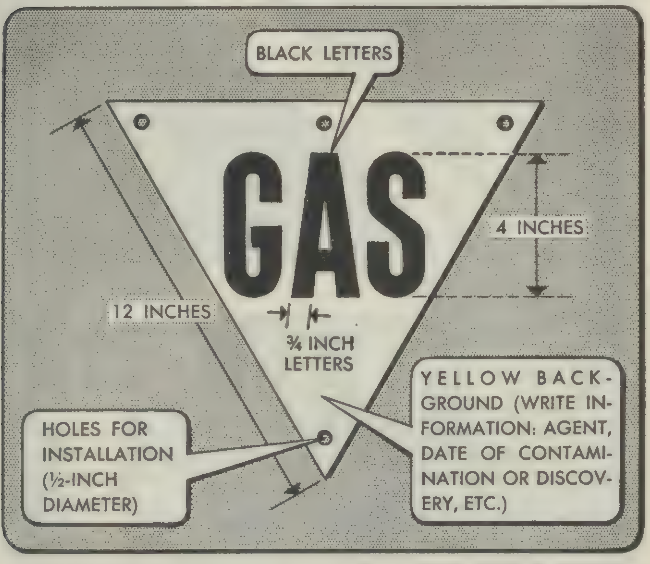


Figure 19. Gas warning sign. The side facing oncoming troops is shown. Sign is of light sheet metal or wood. Reverse side is blank.

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(2) For liquid blister gas contamination, the fabrics may be placed in boiling water for 30 minutes. (But woolen goods should not be boiled or steamed.) As an alternate method, fabrics may be washed in organic solvents, such as gasoline, kerosene, or carbon tetrachloride. They also may be laundered alone, or washed in DANC, followed

Figure 20. Typical personnel decontamination station.

by a rinse in any of the above solvents and a water wash.

(3) Bleach in any form tenderizes cotton fabrics so that they are unusable after a few days.

(4) For emergency decontamination of clothing in the field with protective ointment, see paragraph 102.

n. For polished and working metal parts. These are decontaminated with DANC. Bleach is extremely corrosive to metals. Kerosene or gasoline may be used to wash liquid blister gas from metal parts, but great care must be used to avoid contact with the washings, since gasoline and kerosene only dissolve and do not destroy blister gas. After decontamination, the parts are washed with soap and water and re-oiled. Painted surfaces are repainted, if necessary.

Section VIII. PERSONNEL DECONTAMINATION STATIONS

60. FIELD DECONTAMINATION STATIONS. Fixed installations are described in TM 3–290. A typical field station is illustrated in figure 20. Pertinent details include:

a. Location. Field decontamination stations are established as deemed necessary by commanders of battalions or higher units, and located as far forward as the tactical situation permits. Each station is near a medical aid station, and water for bathing must be available. (See c below.) The area should provide cover from air and ground observation, and is far enough from other installations to prevent danger from vapors from contaminated clothing and equipment.

b. Operation. The station is operated by the commander whose unit has direct jurisdiction over it, but if a Chemical Corps officer is available, he is consulted regarding technical details. Taped-off areas are provided where personnel remove contaminated clothing, bathe, and dress. Each area is supervised by attendants. Arrangements are made for disposal of contaminated clothing and equipment, and for issue of clean replacements. Attendants handling contaminated equipment wear full permeable protective (impregnated) clothing. Contaminated garments are placed in gas-resistant sacks and sent immediately to a designated quartermaster laundry. Other contaminated items are decontaminated, or destroyed if necessary.

c. Bathing facilities. Men contaminated with chemical agents should always bathe after proper disposal of their clothing and equipment. In the field, bathing facilities are provided by the M3A2, 400-gallon, power-driven, decontaminating apparatus and the M1 portable water heater. (See TM 3–223 and 3–228.)

Section IX. ORGANIZATIONAL FIRST AID

61. GAS CASUALTY FIRST-AID KIT. a. General. Use of the gas casualty first-aid kit is a responsibility of troop officers, troop noncommissioned officers, and unit gas personnel. The kit is a medical item of issue. Present issue is 1 kit per 25 men. Responsible personnel must know how to use each item. An instruction sheet is packed with the kit.

b. Contents. Contents of the gas casualty first-aid kit and their uses are shown in figure 21.

Section X. DEFENSE AGAINST INCENDIARY ATTACK

62. STRATEGY AND TACTICS. Incendiary bombs may cause more destruction than any other aerial munition. The incendiary bomb is considered a strategic rather than a tactical weapon, and it has been used mainly against rear area installations, yet its tactical targets include ammunition dumps, advance depots, railheads, airdromes, and supply columns. Incendiary shell, fire bombs, grenades, and flame throwers are primarily tactical.

a. Types of attack. (1) Large incendiary bombs are customarily used only on important installations (point targets), such as airdromes, railheads, docks, depots, and factories.

(2) Small incendiary bombs are dropped in clusters against area targets. These bombs disperse in falling, the object being to start a number of separate fires which merge into a major conflagration.

b. Secondary missions. (1) Explosive incendiary bombs often are included in incendiary bomb clusters. Besides starting fires, they impede incendiary defense.

(2) Fires started may light the way for high-explosive, precision bombing.

c. Characteristics and control of common incendiaries. See figure 7 for a list of common incendiaries and measures for their control.

GAS CASUALTY FIRST AID KIT

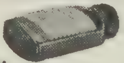
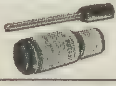
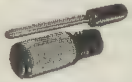
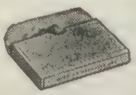
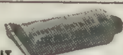
ITEM	USED FOR
1. CHLOROFORM 	Chloroform is used for relief of severe vomiting. The soldier inhales the fumes as required and repeats as often as necessary. In extreme cases, he lies as quietly as possible.
2. CALAMINE LOTION 	Calamine lotion is used after the skin has reddened from blister gas. The lotion is thoroughly mixed, a pad is dampened with the solution and dabbed repeatedly on the affected skin. The lotion relieves the itching as well as the pain from skin burns.
3. COPPER SULFATE SOLUTION 	Copper sulfate solution is used for white phosphorus burns. Cotton pads are wetted with the solution and used like the copper sulfate pads issued to every soldier.
4. EYE and NOSE DROPS 	Eye and nose drops are used for the relief of pain and congestion in eyes and nose. Such pain and congestion may follow exposure to blister gas vapors.
5. BAL EYE SOLUTION 	BAL eye solution is used for blister gases in eyes in the same way as BAL ointment is used. From 2 to 5 drops are placed in the eyes and allowed to stay. If the eye has to be forced open, do it gently. The solution is applied only once and not repeated.
6. COTTON PADS 	Cotton pads are used as needed.
7. AMYL NITRITE 	Amyl nitrite is used for blood and nerve poisons, such as hydrocyanic acid or cyanogen chloride. Two ampoules are broken into a cloth, or in the mask near the mouth, and the fumes inhaled. The process is repeated until eight ampoules have been used. Artificial respiration is administered if the soldier has stopped breathing.
8. BAL OINTMENT (2 TUBES) 	BAL ointment is used for liquid blister gas in eyes in the same way as the tube of BAL in the M5 kit issued to the soldier, or it may be used for lewisite or other arsenical blister gases on skin. Pinch-blot skin dry and apply ointment, rubbing in well.
9. PROTECTIVE OINTMENT 	Protective ointment is used to decontaminate liquid blister gas in the same way as the tubes of protective ointment in the M5 kit issued to the soldier.

Figure 21. Gas casualty first-aid kit.

63. ORGANIZATION FOR DEFENSE (see TM 5-315).

a. Responsibility. Fire defense is a command function and responsibility. The organization for defense against incendiaries is headed by the division engineer, who may be appointed fire marshal. Corps of Engineers fire appliance troops fight appliance fires in a theater of operations. The chemical officer may be designated as adviser to the fire marshal.

b. Existing organization. The existing organization for protection against air attack must provide for incendiary defense.

c. Fire department cooperation. A single small incendiary may cause an appliance fire (one which cannot be brought under control by a fire-fighting squad, but must be attacked with professional fire-fighting apparatus). In a theater of operations, large appliance fires are controlled by Army engineer fire appliance troops. In the United States, civilian fire-fighting organizations or civilian employees of the Army must fight these larger fires.

d. General plans. While no detailed plan will cover all situations, the following are important points in setting up a defense plan:

(1) Assign fireguard duty in addition to regular duty. Station the fireguards at point targets or important installations and use them as patrols in important areas during emergencies.

(2) Improvise additional equipment.

(3) Keep an inventory of locations of all materials and equipment useful in fighting incendiary

bombs. This record should be maintained by the officer responsible for the fire protection of the area.

(4) Keep fire-fighting supplies and equipment near all vital centers.

(5) A military area should be divided into sectors, with an officer responsible for the organization and its functioning in each sector.

(6) An air raid protection organization should be set up. (See FM 1–25.)

e. Training. All personnel should be trained to use available fire-fighting equipment and taught to recognize various types of incendiaries and their characteristics.

f. Advance fire defense planning. (1) *General.* Advance planning and a complete understanding of the plan by all responsible officers are essential. Surveys should be made and a standing operating procedure should be established. Simplicity of plan is of prime importance.

(2) *Classification of areas.* As part of the advance planning, areas should be classified according to type of construction, amount of roof coverage, and tactical importance.

64. MEANS OF DEFENSE. Defense against incendiaries must be aggressively conducted.

a. Precautionary measures. Inspections should be made to insure that—

(1) Readily flammable materials are kept in nonflammable containers.

(2) Waste materials are not allowed to accumulate.

(3) Wooden surfaces, where practicable, are coated with whitewash, water-glass solution, or other fire-resistant material (properly camouflaged).

(4) Materials for fighting incendiaries are readily accessible.

(5) A practical incendiary spotting and alarm system is in operation.

(6) Combustible supplies are dispersed.

(7) Ingenuity is employed in improvising supplementary equipment.

b. Incendiary defense organization. (1) A unit defense organization should be established and taught to use available equipment.

(2) Periodic defense drills should be held. Anti-incendiary discipline of the entire unit should be stressed.

(3) Handling of small incendiaries is a technique that the individual soldier can be taught, just as he is taught the technique of individual gas protection.

(4) A fire guard for first-line defense should be established, consisting of individual fire guards equipped with and trained to use simple fire-extinguishing equipment.

(5) If civilian communities with organized fire-fighting services are near, liaison should be maintained in order to obtain aid for control of fires.

c. Equipment. (1) *General.* In the field, incendiaries and the fires that they start must be con-

trolled with equipment on hand for fighting ordinary fires and with improvised equipment. This includes water buckets and barrels, sand and sand bags, garden and fire hose, burlap bags, axes, shovels, flashlights, rope, gas mask or goggles, and gloves. Pump tanks, 3-gallon or 400-gallon decontaminating apparatus, and soda-acid or carbon dioxide extinguishers may also be available. Fire-fighting equipment must be kept in convenient, readily accessible places known to all.

(2) *Hose.* Prompt flooding with a stream of water from a hose will soon extinguish or control most small incendiary bombs of any type. The high-pressure "fog" nozzle is most effective for oil incendiaries.

(3) *Fire extinguishers.* The chief disadvantage of most fire extinguishers is their small capacity. Use of the carbon tetrachloride extinguisher is not advisable in confined spaces because of the possible generation of toxic fumes. Soda-acid and water types should not be used directly on oil since they tend to spread the fire. The fog nozzle type of extinguisher is effective.

(4) *Water barrels and buckets.* Barrels (kept full of water) and buckets should always be available. In freezing weather, salt should be added to the water in outdoor barrels.

(5) *Sand.* Even if there is no lack of other equipment, sandbags should be conveniently placed, and containers of dry sand should be available for smothering effect. Twenty-pound sandbags are best for quick and easy handling. Twenty-

pound bags, 15 by 12 by 3 inches, are known as sand mats.

(6) *Other equipment.* Pump tanks, knapsack-type pumps, or the 3-gallon decontaminating apparatus are useful when fire or garden hose is not available. Shovels may be used to scoop up bombs or their molten particles for removal to places of safety. The 400-gallon decontaminating apparatus is excellent for fighting fires.

65. METHODS OF COMBATING INCENDIARIES IN IMPORTANT STRUCTURES. a. General. When an incendiary falls into an important building or area, such as an oil or ammunition depot, an attempt must be made to control the fire in spite of the risk involved.

b. Precautionary measures. A percentage of incendiary bombs usually contains high explosives. Unless known to the contrary, all incendiary bombs must be considered to be of explosive type and treated accordingly. Ordinary room walls, tables, chairs, and similar objects do not provide a safe shield for a hose operator fighting such bombs. A brick wall offers adequate protection only against small explosive incendiary bombs. Only one fire fighter should risk exposure in an attempt to extinguish a bomb. When cover is available, the fire fighter's body should be shielded so only the hands are exposed. Helmets should be worn. When cover is not available, fire fighters operate from a nearly prone position and from a distance as great as equipment permits.

c. Employment of equipment. (1) *Shovels.* Shovels can be used to scoop up incendiary bombs after

the danger time for explosion has passed. Bombs can then be thrown in a place where no damage will be done.

(2) *Sand mats.* Sand mats can be used to smother bombs. Fighters should then take cover, or run 20 yards away and lie flat. This method should be used only when incendiaries are known not to contain explosives. Sandbags or mats reduce fragmentation of explosive bombs to some degree; some fragments are confined, and those which escape are dispersed over a substantially reduced area.

(3) *Loose sand.* Loose sand may be thrown around the bomb, helping to smother fires started by it. Sometimes it may be necessary to cover the bomb with sand and scoop it or the molten particles into a shovel. The bomb or particles are placed in a bucket partially filled with sand. More sand is placed on top, and the bomb is carried to a safe place. This method must not be used for explosive incendiaries.

(4) *Water or fire extinguishers.* Water or fire extinguishers are employed immediately against bombs falling in vital structures, regardless of whether sandbags or sand mats are used. Carbon tetrachloride extinguishers should not be used in confined places because they may generate toxic fumes. Soda-acid and water extinguishers should not be used directly on oil since they tend to spread the fire. The fog nozzle extinguisher, however, is effective. Water can be used against other types of incendiaries. It may be projected from a hose, pump tank, knapsack-type pump, or 3-gallon

decontaminating apparatus, or small quantities can be thrown from a can or canteen cup. Water serves two purposes—it confines the spread of the fire by wetting down the surrounding area, and it controls the magnesium types of incendiaries by increasing their rate of burning (or it extinguishes them if enough is used). Throwing large quantities of water or projecting a stream on a bomb causes scattering, but also forces the flaming particles away from the fighter.

(5) *Decontaminating apparatus.* The 400-gallon decontaminating apparatus can be used in the same manner as regular fire-fighting equipment if trained operators are available.

66. INSPECTION AFTER INCENDIARY ATTACKS. a. General. After an incendiary attack, maintain a watch for several hours to make certain that fire does not again break out.

b. Phosphorus or oil. When phosphorus or oil bombs have been used and the filling is spattered on walls and floors of buildings, the liquid must be kept wet and scraped away with a hoe, scraper, or knife. Then, as the surfaces dry, they must be watched for re-ignition of remaining incendiary.

c. Unexploded bombs. After each incendiary attack, a careful inspection must be made for bombs which have not detonated, and for separated explosive portions which have not detonated.

(1) When such missiles have been located, the spot should be marked with a sign, "Unexploded Bomb," the area roped off, personnel excluded, and the bomb-disposal officer notified. Under no

circumstances will untrained personnel handle these unexploded bombs.

(2) Combustible materials should be removed from the immediate vicinity to prevent their ignition in case the bomb explodes.

(3) Bomb disposal is a function of the Ordnance Department. Bomb-disposal crews should be notified through channels.

d. Equipment. Immediately after a fire has been extinguished, all fire-fighting equipment should be inspected, restored to working condition, and returned to its usual place.

CHAPTER 8
TACTICAL PROTECTION

Section I. INTRODUCTION

67. GENERAL PRINCIPLES. Tactical protection includes both active and passive chemical defensive measures taken to defeat enemy chemical warfare action. Maneuver of troops is planned so that gassed areas may be avoided or if avoidance is impossible that they are crossed at points most favorable to the security of the troops involved. Supply movement is planned so that traffic may be routed over alternate routes to avoid contaminated areas. Positions are organized so that alternate positions can be occupied in the event of a gas attack. Alternate positions are selected with a view of counteracting enemy action against the main position as well as affording security against enemy chemical agents released on the primary position. While executing the mission of attacking or defending a position, casualties may be avoided or minimized by the following measures:

a. Exposing the least number of personnel.

b. Exposing personnel for the shortest possible time.

c. Exposing personnel to the lowest possible concentration of war gas. (See appendix I for data on the approximate duration of hazard from mustard gas contamination.)

68. FACTORS OF TACTICAL PROTECTION. Specific factors in tactical protection (discussed in paragraphs 69 through 86) include the following:

a. Planning. (Plans include the general *standing operation procedure* as well as *tactical plans* based on estimates of the situation.)

b. Chemical reconnaissance.

c. Chemical intelligence.

d. Maneuver.

Section II. PLANNING

69. STANDING OPERATING PROCEDURES. Standing operating procedures (SOP) are orders issued by army, corps, division, or task force, setting forth definite and uniform procedures for chemical defense of the commands. Their adoption tends to eliminate repetition of orders, minimizing danger of confusion and error in combat. SOP's for chemical defense are based on recognized methods of individual and collective protection, and are modified as means and knowledge of protection improve. The various units of a command enforce the SOP and prepare additional plans specifically required for protection of personnel. A guide to the principal items is shown in figure 22.

70. TACTICAL PLANS. a. General. Tactical plans apply to the local situation. They are carefully coordinated into the general scheme of attack or defense.

b. Estimate of the situation. In estimating the situation and drawing up plans, commanders (assisted by chemical officers or unit gas officers) should consider:

(1) The factors set forth in paragraphs 29 through 36 of this manual.

SOP CHECK LIST

SOP may be published in various forms, among them being orders, circulars, memoranda, and training memoranda

✓ GENERAL

a. References
b. Administration and personnel (chap. 2)

✓ GAS DISCIPLINE (chap. 9)

a. Carrying gas mask
b. Wearing mask and other protective items
c. Maintenance of gas discipline

✓ TRAINING (part three)

a. Standards of proficiency
b. Field exercises

✓ INDIVIDUAL PROTECTION (chap. 9)

✓ COLLECTIVE PROTECTION (chap. 7)

a. Gas sentinels
b. Alarms
c. Detector devices
d. Protection of materiel
e. Gasproof shelters

✓ TACTICAL PROTECTION (chap. 8)

a. Chemical intelligence
   (1) Reports
   (2) Channels for reports
b. Chemical reconnaissance
c. Procedures under enemy chemical attack

✓ DECONTAMINATION (chaps. 7 and 9)

a. Individual
b. Equipment and supplies
c. Areas
d. Decontamination personnel

✓ SUPPLY (app. III and FM 3-15)

✓ FIRST AID FOR CHEMICAL CASUALTIES (chaps. 4 and 9)

✓ CHANNELS OF COMMUNICATION BETWEEN UNIT GAS OFFICERS AND DIVISION CHEMICAL OFFICER (chaps. 8, 11, and 12)

Figure 22. Items to be considered in SOP.

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(2) The capabilities of enemy weapons and chemical agents.

(3) The weather, terrain, and tactical situation.

c. **Surprise.** Generalities have been drawn to show situations which favor enemy use of one kind of chemical agent over another. Favorable weather conditions and a large number of hostile troops are usually considered essential to successful nonpersistent casualty gas attacks. Persistent casualty gas is often used to create or strengthen obstacles, against areas difficult to capture by assault (which the enemy does not intend to occupy immediately), or against marching troops or installations. Surprise, however, should always be guarded against. An enemy may use nonpersistent gas under unfavorable conditions. He may assault a position he has just contaminated with persistent casualty gas. Commanders should be constantly on the alert for signs of an enemy chemical attack, no matter how unfavorable conditions may appear.

Section III. CHEMICAL RECONNAISSANCE

71. DISTANT RECONNAISSANCE. Explorations of objectives which lie outside the immediate striking range of a force are conducted by aerial observers and by highly mobile ground forces. Special attention is given areas which would normally be covered in the next several days' operations. Aerial photographs and distant ground observation show location of terrain which, if contaminated, might hamper advancing troops. Enemy chemical activity, such as installations of chemical

land mines, may also be revealed. Information may come through raids or by questioning prisoners and inhabitants.

72. CLOSE RECONNAISSANCE. Chemical reconnaissance becomes more detailed as opposing forces draw together, and particular attention is given to selecting halting points, camp sites, routes of approach, and battle positions favorable or unfavorable to enemy gas attack. Aerial observation and ground reconnaissance help develop information on the enemy's chemical operations, but each unit is responsible for reconnoitering its own front and flanks, routes, and alternate routes of approach. Reconnaissance of gassed areas is difficult at night; accordingly, daytime observation is advocated. But an immediate and quick reconnaissance to determine best means of passage is necessary whenever a gassed area is encountered unexpectedly, day or night. Procedures are as follows:

a. For areas known to be gassed. The reconnaissance party, suitably protected, examines the area to obtain the following information:

(1) Kind of gas and concentration (heavy, light, medium).

(2) Location and extent of contamination.

(3) Routes for troops and vehicles upwind and downwind of the area, and advisability of masking.

(4) Feasibility of preparing a road, or of using established paths or roads through the area.

Part of the group goes upwind to define the edge of the area and explore the possibility of passage

there. Other personnel make a similar reconnaissance on the downwind side. Detection devices are used periodically. Occasionally personnel may test for gas by sniffing, but as infrequently as possible. After extent of the area is determined, it is marked with gas warning signs (figure 19) showing the kind of gas and date of contamination or discovery. Units approaching from the rear are notified. If necessary, sentinels are posted to give warning. Whether passage is made depends on amount of contamination, size of area, availability of routes for bypassing it, terrain and weather conditions, extent of hazard involved, and immediate tactical urgency.

b. For areas suspected of contamination. Careful examination is made of such areas, with special attention to low-lying patches of woods, defiles, ravines, stream beds, areas covered with high grass or underbrush, and other spots favorable to contamination with persistent casualty gas.

73. BATTLE RECONNAISSANCE. This consists principally of gathering information on the enemy's chemical activities, actual and potential. After a gas attack, battle reconnaissance includes location of gas-free areas and information on which to base recommendations for possible evacuation of contaminated areas.

Section IV. CHEMICAL INTELLIGENCE

74. SOURCES. After information of military value is collected, it is evaluated by intelligence personnel and disseminated. Only after evaluation does such information become intelligence. Chemi-

cal intelligence (like military intelligence in general) may have two main sources: *War Department* (produced under the War Department General Staff in peace and in war) and *combat* (produced in the field by military intelligence sections after the outbreak of hostilities). A complete discussion, including the gathering and evaluation of information and the channels involved, appears in FM 30–5.

a. War Department intelligence. War Department intelligence summaries and bulletins are issued for units in the field by higher headquarters. Summaries and bulletins contain information on general chemical warfare developments and on results of research and experimentation. They are furnished to the division chemical officer for distribution to all concerned.

b. Combat intelligence. Combat intelligence is based on information gathered by reconnaissance and observation (or by other reliable means) on enemy chemical activity, and is handled through regular intelligence channels. (See FM 30–5.) The intelligence itself is furnished to the unit commander by G–2 or his assistants by personal contact, special messages. conferences, periodic reports, or special reports. This intelligence is used by the commander in planning his organization's chemical defense.

c. Collecting agencies. Collecting agencies and sources of information available to combat units depend upon the size of the units. In large units, chemical laboratory companies and military intelligence personnel may be included. (The bat-

talion is the smallest unit provided with intelligence personnel.) Collecting agencies may draw information from such sources as interrogation of prisoners, examination of enemy chemical materiel, or samples of contaminated earth. In smaller units, sources of information are limited to patrols and to unit gas personnel.

d. Factors important in combat intelligence. The following factors are guides (not limitations) to what is most important in both chemical information and intelligence.

(1) Local weather conditions favorable or unfavorable for enemy chemical attack.

(2) Chemical offensive preparations of the enemy, including his capabilities for using gas, character and amount of his chemical weapons and ammunition, location and disposition of his chemical troops, and location of weapons and munitions for dispersing gas.

(3) Terrain which is a good target for gas, especially terrain likely to be crossed or occupied by friendly troops.

(4) State of enemy gas training, discipline, and protective equipment.

(5) Data regarding any particular gas attack (paragraph 75), and official report form. (See figure 23.)

(6) Data on friendly troops, including friendly use of chemical agents. state of protective equipment, and protection available for food, water, and general supplies.

75. REPORTS. All chemical information, no matter how unimportant it seems, is sent from forward

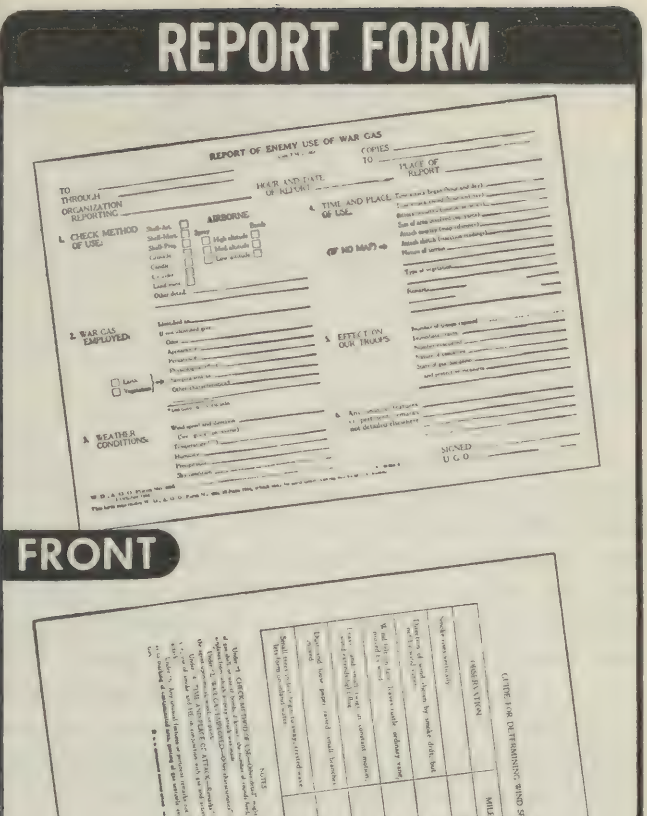

Figure 23. Report form.

elements through channels to division, corps, army, or task force G–2 centers. When information of no apparent consequence is properly evaluated, it may prove to be the missing fragment which completes the picture. Reports may be *immediate* or *special.*

a. Immediate reports. These are sent by the unit gas officer, immediately after a gas attack, noting—

(1) Time.

(2) Place.

(3) Extent of attack.

(4) Kind of gas (if known).

(5) Type of weapon used (if known).

To save time, this information may be given verbally to S–2 and the division chemical officer. The unit gas officer then completes WD AGO Form 890, report of enemy use of chemical agents, (shown in figure 23), basing his report on personal reconnaissance. This report also goes to S–2 and the division chemical officer. If the unit is not a part of a division, copies of reports are sent to the chemical officer on the staff of the organization under which the unit is operating.

b. Special reports. These are submitted as requested. Special reports may be made necessary by G–2 requests in accordance with a definite mission, or to establish a missing fact. Copies are furnished the chemical officer.

76. RECORDS. a. Statistical records. Data on both enemy and friendly chemical attacks are prepared by the division chemical officer and sent to higher headquarters for study and record. Data required

may cover the same subjects as WD AGO Form 890. This information is obtained from such sources as G–2, artillery, chemical troops, medical officers, and unit gas officers.

b. Reference records. (1) These are made on all items of information, in a manner convenient for study and reference. The G–2 journal, work sheet, or situation map may be used. The division chemical officer and unit gas officer should maintain records similar to these when needed, including a special chemical situation map.

(2) A chemical situation map embraces the area over which the unit is operating, plus pertinent adjacent areas. The scale is the same as that of maps used by G–2. or G–3, or S–2 or S–3, in making their overlays. It shows areas contaminated both by friendly and enemy troops, type of gas, relative degree of contamination, and date gas was laid or discovered. Unit boundaries, important installations, and other important data are indicated.

77. COUNTERINTELLIGENCE. This function aims at destroying effectiveness of the enemy's intelligence system. General application of counterintelligence measures is described in FM 30–25. Unit gas officers and noncommissioned officers advise their commanders on this subject. Means of counterintelligence include:

a. Security.

b. Gas discipline.

c. Tactical missions to deceive the enemy.

d. Precautions in movement of personnel and materiel.

e. Counterpropaganda and counterespionage.

f. Destruction of chemical materiel when its capture is imminent.

Section V. MANEUVER

78. GENERAL. Maneuver as applied to chemical defense includes movements to place troops and materiel in more favorable positions with respect to defense against enemy chemical attack. Tactical maneuvers under various situations are discussed in the following paragraphs. Emphasis is on avoidance of casualties from persistent casualty gases.

79. SELECTION OF ROUTES AND POSITIONS. Routes and positions, together with alternates, are chosen when any movement is decided upon. The alternate choices are reconnoitered carefully. They should be favorable both for accomplishment of the mission and for protection against gas attack.

a. Alternate routes. Alternates are used when the original route becomes impassable, provided the march mission is not jeopardized. In planning an alternate route. possibilities of air chemical attack are considered, and suspected areas reconnoitered in advance. Enemy air action is likely to occur in defiles or valleys where gas tends to accumulate; such action may be expected when the enemy believes it is too late for an advancing force to make new plans.

b. Alternate positions. For halts, bivouacs, entrucking, detrucking, or assembling, alternate positions are chosen in the same manner as alternate routes.

c. Factors. In choosing routes and areas, whether

original or alternate, the following are of particular chemical defense application:

(1) *Elevation.* Gas tends to drain to low ground; high ground therefore, is preferable unless contaminated. Air currents in corridors, however, may tend to carry gas up slope and up valley during the day, down slope and down valley during the night.

(2) *Concealment and cover.* Woods in leaf offer the advantage of concealment and some measure of cover against spray. Woods with good overhead cover and clear ground beneath are preferable, but concentrations are often higher in woods than in the open.

(3) *Freedom from underbrush.* If heavily contaminated, low scrub and long grass may contaminate troops badly. Further, gas vapors linger in heavy undergrowth (particularly if the ground is low), and concentrations may be high there.

(4) *Accessibility of water.* Water supplies are important for decontamination.

(5) *Means of entrance and exit.* Choose paths or roads which are not in themselves dangerous from a contamination viewpoint.

(6) *Ample area for dispersion.*

(7) *Good observation for sentinels.*

(8) *Other tactical or supply factors.* These may outweigh certain of the above. Protection from chemical attack may have to be a compromise with protection from small-arms fire, and from armored or air attack.

80. BYPASSING A GASSED AREA. a. Maneuver. Whenever possible, troops should be moved up-

wind of a contaminated area. If the situation requires a downwind passage, it is usually safe for masked troops to pass at a distance equal to the depth of the area, but the vapor concentration and weather factors must be considered. Unless the mission demands it, personnel should avoid remaining downwind; troops held there may suffer casualties even if the vapor concentration is low and the contaminated area small. Furthermore, the effects of blister gas are cumulative. If possible, soldiers should not be exposed to blister gas vapors if their skin is red from previous exposure.

b. Detection of blister gas. Troop officers must remember that the odor of mustard gas does not necessarily indicate dangerous amounts of vapor. Harmless impurities (which have an odor similar to the original mustard gas) or reaction byproducts from decontamination may remain in the area after the danger has disappeared. (See paragraph 44.) The M9 chemical agent detector kit should be used and the table in appendix I consulted.

81. EVACUATION OF POSITIONS. If a position already occupied is heavily contaminated, casualties may be unavoidable. Tactical considerations may require that such a position be held. If the mission can be accomplished by occupation of a previously chosen alternate position, the gassed area may be evacuated and the alternate position occupied. In no case should evacuation of an original position be undertaken until it is clear that the enemy is using blister gas in quantities sufficient to jeopardize the mission of occupying troops. If the po-

sition once evacuated is threatened by enemy occupation, it should be reoccupied if it is sufficiently important.

82. OPERATIONS IN GASSED AREAS. After a suitable lapse of time after gassing, operations can be conducted safely even in areas contaminated with blister gas. Time limits vary, depending upon protective clothing, temperature, type of contaminated soil and terrain, and task to be performed. The M9 chemical agent detector kit should be used and appendix I consulted to determine approximate time limits after which tasks can be performed in gassed areas.

a. On the march. When the mission requires, troops must pass through (or even remain in) contaminated areas. In such cases, operations may be carried on with the minimum number and least severity of casualties if good gas discipline is maintained and all practicable measures of individual and collective security are carried out. In addition, certain techniques are helpful:

(1) Use hard surface roads, if available.

(2) If roads are muddy, warn men to avoid splashing, and make certain that the wheels of vehicles, and the feet of both men and animals are cleaned after area has been crossed. Locate shuffle areas of dry mix at either end of crossing.

(3) Troops should be instructed to avoid visible liquid contamination, whether fresh or old, and especially to avoid contact of liquid with the bare skin.

(4) In motor movements, guard personnel against splashing from branches or from contaminated water and mud on roads.

(5) If area is dry and dusty, avoid raising clouds of contaminated dust.

(6) Move rapdly, reducing time of exposure to vapor. (Remember that troops tire quicker if dressed in protective clothing and masked.)

(7) If tactically possible, burn contaminated vegetation along the route, avoiding exposure to concentrated vapors produced by burning.

(8) If practicable, assign details dressed in impermeable protective clothing to cut lanes in advance through areas of contaminated vegetation.

b. Protection during pursuit of enemy. This is achieved by thorough reconnaissance and observance of all other chemical defense measures. The enemy is likely to use blister gas extensively in rear guard action; therefore, a pursuing force must guard constantly against contaminated ground.

83. LONG-PERIOD OCCUPATION OF CONTAMINATED JUNGLE AREAS. When contaminated areas are limited in extent, troops may be moved to uncontaminated areas for eating, drinking, and personal relief. When the contaminated area is extensive, no gasproof shelters are available, and troops must remain within it for long periods (24 hours or longer), the following procedures are suggested:

a. Preliminary reconnaissance. A search should be made for sites likely to become gas-free at the

earliest time, and for sites of least liquid contamination. It may be necessary to redispose troops so that they occupy areas free from liquid contamination.

b. Eating and drinking. No attempt should be made to remove masks within the first 4 hours after a heavy mustard gas attack. After this time, tests with the M9 chemical agent detector kit should be made at the sites discovered in the preliminary reconnaissance above.

c. Urinating and defecating. A site for a latrine area is chosen in the preliminary reconnaissance, and men must be warned of the necessity for using only the latrine area designated. For urinating, the fly of the protective clothing is unbuttoned to almost its full length with the gloved hand and the fly of the drawers widely exposed. The drawers are then unbuttoned with the bare hand. The genitals should not be exposed for more than 1 minute. The reverse procedure is followed in rebuttoning the clothing. For defecating, the trousers should be lowered with the gloved hands, and the drawers lowered with the bare hands. The clothes should not touch the ground, and caution must be exercised to avoid touching twigs or grass with the bare skin. The genitals should not be exposed more than 2 minutes. The reverse procedure is followed when adjusting the clothing.

d. Sleeping. Sites for sleeping should be chosen during daylight so that areas with liquid contamination can be avoided. A fox hole is dug, or the surface is scraped away even though no con-

tamination is visible. A protective cover (or poncho) is placed under the body but not over it, since blister gas vapor may be trapped. Masks should be worn, and sentinels must see that men do not pull them off while asleep.

84. AREA DECONTAMINATION. Large areas are seldom worth the effort required to decontaminate them. Smaller areas, such as roadways, road blocks, and bridges, may be decontaminated according to procedures outlined in paragraphs 57, 58, and 59, and in TM 3–220. General measures are described in paragraph 85.

85. TACTICAL DECONTAMINATION MEASURES. Unless it is tactically necessary to go through, it is advisable to bypass a contaminated area. Hazard to the troops is evaluated by the commander. Combat decontamination is limited to points important to the conduct of attack, defense, or special operations. Organization and employment of decontaminating personnel is as follows:

a. Gas reconnaissance and decontaminating parties. Such parties accompany advance guards or other covering forces during movements when persistent casualty gas may be encountered. Decontaminating personnel, wearing protective clothing and equipped with tools and decontaminants, can handle minor gas situations.

b. Decontaminating. All troops are trained in methods of decontaminating personal equipment, and, when necessary, unit equipment, supplies, and areas. In addition, a squad of 4 to 11 men may be designated in each company or similar

unit to serve as a unit decontaminating squad, reinforced by additional personnel as needed.

c. Operations of decontaminating personnel. In larger decontaminating operations, decontaminating personnel may be grouped together under immediate supervision of a unit gas officer. Whenever a blister gas attack is anticipated, decontaminating personnel and materials should be moved as near as feasible to the anticipated site of attack so that decontamination can be accomplished quickly. Decontamination is always held to the absolute minimum consistent with execution of the mission.

d. Unit action following a gas attack. Battle readiness is restored immediately. First aid is given and chemical casualties evacuated as soon as possible. Shelters are ventilated and prepared for future use. Proper disposition is made of contaminated food and water. Essential decontamination is conducted on weapons, other individual or organizational equipment, and terrain. Replacement protective equipment is promptly requisitioned, secured, and issued. See appendix III for supply channels.

86. PROTECTION AGAINST NONPERSISTENT CASUALTY GAS ATTACK. Tactically, the enemy may be expected to assault a given position soon after he lays down a nonpersistent casualty gas attack upon it. Troops must be prepared to repel such assaults. Such preparations should be completed as soon as possible after the gas attack is made. Any unnecessary movement should then cease until the assault is made or until the gas laid down

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by the enemy has disappeared. Sometimes enemy gas attacks can be forestalled by air or artillery bombardment of the enemy's positions. Even if the gas attack is not forestalled, the enemy's following assault may be stopped by immediate bombardment.

PART THREE
TRAINING IN DEFENSE AGAINST CHEMICAL ATTACK

CHAPTER 9
THE INDIVIDUAL SOLDIER

Section I. DEGREE OF TRAINING

87. GENERAL: PURPOSE AND SCOPE. This chapter outlines the basic chemical defensive measures every individual is required to know in order to carry out his mission with the least risk from chemical agents (paragraphs 89 through 107). It includes the standards of proficiency the soldier is to meet in training, and an outline which may be used by unit officers charged with training the soldier in chemical defense. (See paragraphs 108 through 118.) The information and techniques to be learned by the soldier are simplified. If greater detail is required, part two (operations) should be consulted. Commanders should consult paragraphs 37 through 40, for their responsibilities in the individual soldier's defense.

88. STANDARDS OF PROFICIENCY FOR INDIVIDUALS. Individual soldiers must be trained to meet the following standards of proficiency. Every soldier should:

a. Be familiar with the indications of the presence of chemical agents.

b. Realize the potentialities and effects of chemical agents.

c. Know how to use his gas protective equipment to avoid or lessen injury.

d. Keep his protective equipment in good condition.

e. Know what to do for injuries from chemical agents.

f. Be able to decontaminate himself and his own equipment.

g. Be familiar with the chemical defense duties of sentries, and know the sound of the local gas alarm.

h. Know how to deal with incendiaries.

Section II. CHEMICAL AGENTS, DETECTION, BEHAVIOR AND EFFECTS

89. GENERAL. There are three broad groups of chemical agents: war gases, screening smokes, and incendiaries. These may appear as gases, liquids, or solids. With regard to the defense measures required, the war gas group is the most important. Those which, met in the field, can kill or injure unprotected men (have a casualty effect) include blister gases, choking gases, and blood and nerve poisons. Those which cause discomfort and irritation but no permanent injury (have only harassing effect) include vomiting gases and tear gases. (See figure 4.) The soldier need not learn to recognize a large number of individual chemical agents, but he must learn to recognize the indications which warn of the presence of blister gases, choking gases, blood and nerve poisons, vomiting gases, tear gases, screening smokes, and incendiaries as groups. In training, these are discussed as groups rather than as separate chemical agents.

90. METHODS OF DETECTION. Detection devices (paragraphs 42, 43, and 44) are used for determining the presence of dangerous amounts of war gas when any doubt exists, but these are not ordinarily available to the individual soldier. He must depend upon his senses, with emphasis on what he smells, sees, feels, and hears.

a. Odors. Some war gases may be almost entirely odorless, but many of them have identifying smells. In battle, however, any unusual odor not explainable by objects in the vicinity may indicate the presence of war gas. The following descriptions of odors are to be taken as guides only. Odors do not smell alike to all individuals.

(1) The odors of blister gases have been compared to the odors of onions, garlic, geraniums, fish, or soap. Some may have a fruity odor.

(2) Choking gases are sometimes said to smell like freshly cut hay, green corn, or fly paper.

(3) Blood and nerve poisons may have very faint odors. They may smell like peach kernels or bitter almonds, like garlic or rotten cabbage, or they may be highly irritating to both the nose and the eyes.

(4) Vomiting gases may smell like burning fireworks or shoe polish, or they may produce a pepperlike irritation in the nose and throat.

(5) Tear gases may smell like apple blossoms, but a better warning is the immediate flow of tears.

b. Sight. War gases which are vapors under usual field conditions are usually invisible, although some may be seen as a haze immediately

after release, or may appear as colored clouds. Liquids can usually be seen. Sight in general, however, has its limitations in the detection of chemical agents.

(1) Blister gases range from colorless to dark brown and may be either liquid or solid. They give off vapors which are dangerous. A dark haze can be seen behind an airplane when a spray attack is made.

(2) Choking gases are usually invisible, but they may form a momentary white cloud upon release.

(3) Blood and nerve poisons are usually invisible after release.

(4) Vomiting gases may resemble smokes, white or colored. Some may be canary yellow near the point of release.

(5) Tear gases are usually invisible in the field, but they may appear to be a white dust cloud.

c. Feeling. Gas either in liquid or vapor form may give a burning, biting, choking or prickly feeling in the nose, throat, lungs or on the skin. The effects of gas may also cause dizziness, sneezing, vomiting or produce headaches.

d. Hearing. When war gas munitions explode, the detonation is usually of a low order in contrast to that of a high explosive munition. This principle is not always a safe guide, however, since high explosive may be used with war gas. A patter may be heard when droplets of spray come to earth.

91. PHYSICAL BEHAVIOR OF CHEMICAL AGENTS.

a. War gases. War gases may be dangerous in the

open longer than 10 minutes at the point of release (and thus be persistent), or they may become so diluted during that period that the danger is gone (and thus be nonpersistent). They are called moderately persistent if they remain from 10 minutes to 12 hours.

(1) In general, only blister gases and certain nerve gases are persistent in the open, but some of the other groups may be dangerous in low places and wooded sections for periods considerably longer than 10 minutes. Liquid blister gases evaporate slowly, giving off dangerous vapors. These vapors, like nonpersistent gases, tend to flow toward low places; thus high concentrations may be found where the soldier would normally look for cover and concealment. Furthermore, the soldier's clothing and equipment may come into contact with drops of blister gases caught on vegetation.

(2) The nonpersistent gases, since they appear as relatively small amounts of gas mixed with large amounts of air, behave as air currents do. On sunny days, they rise quickly from the ground with the air; on cloudy days and at night, they travel along the ground, sometimes for long distances.

b. Screening smokes. The primary purpose of screening smokes is to prevent observation, rather than cause injury. Smokes are made by burning certain substances, by releasing certain liquids which turn into fog, or by mixing oil and steam. Some smokes may cause injury, however, particularly if breathed in closed spaces or close to

the point of release. Burning particles of white phosphorus cause painful injuries and may start fires.

c. Incendiaries. Incendiaries cause fires which may burn personnel as well as materiel and installations. They are usually made of metals, oils, or white phosphorus. The soldier must be able to distinguish white phosphorus, since he applies a special first-aid procedure for its burns. All incendiaries burn at high temperatures and are very difficult to extinguish. Emergency control is explained in paragraph 107.

92. EFFECTS OF CHEMICAL AGENTS. The effects of chemical agents on the body vary. Some are more harmful than others, and the same chemical agent may be more harmful at one time than at another. Even the reactions of individuals vary. The paragraphs below point out the effects that chemical agents might be expected to have on most men who are *unprotected.* The first three types of war gases can kill unprotected men in field concentrations. Means of protection by which the effects of chemical agents may be avoided or minimized are discussed in paragraphs 93 through 98.

a. Blister gases. Both liquids and vapors act primarily on the eyes and skin, especially hot and moist skin such as that in the crotch or armpits. They damage the respiratory tract when breathed. When absorbed, they may cause poisoning of the system. Some blister gases contain arsenic and are more dangerous in this respect than others.

The harmful effects are usually delayed for several hours, although pain may occur immediately.

b. Choking gases. Choking gases primarily irritate and damage the breathing passages, especially the lungs. Such damage may be delayed as much as a day or two, and the victim suffers from effects similar to those caused by pneumonia. If the gas smells like flypaper, its liquid form may cause burns to the eyes or blisters on the skin.

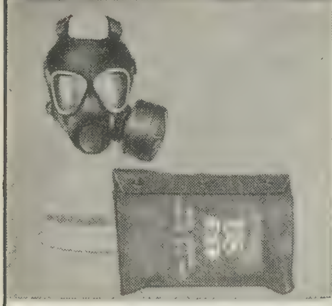
c. Blood and nerve poisons. In high concentrations, these war gases may act within a few seconds after a few breaths. They affect the nervous system and the blood stream. Lower concentrations also may be dangerous, but sometimes effects are delayed for several hours. They may cause intense tears to flow and irritation to nose and throat.

d. Vomiting gases. These irritate the nose, throat, and eyes and cause headache, vomiting, coughing, sneezing, and discomfort. Permanent injury is unlikely in field concentrations, but concentrations in closed spaces may be dangerous. Symptoms sometimes temporarily grow worse even after the mask is adjusted, but the soldier must nevertheless keep his mask on.

e. Tear gases. Tear gases cause pain to the eyes, and tears flow freely. They may also sting the skin, especially the freshly shaved face, the neck, and moist surface of the body. Contamination of the eye with both liquid and solid tear gases causes severe pain.

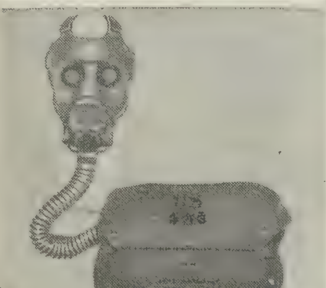
f. Screening smokes. Smokes used by friendly troops in field concentrations are usually harm-

TYPES OF GAS MASKS



COMBAT SERVICE MASK is designed for combat troops. The canister is connected directly to the side of the facepiece. The carrier is waterproofed and is worn strapped to the body or to the leg. Several carrying positions are possible. The carrier is buoyant in water.

LIGHTWEIGHT SERVICE MASK is packed in a small carrier that may be worn in several positions. The canister is connected to the facepiece by a hose. A nose-cup in facepiece prevents fogging of lenses. Pockets in the carrier are used for miscellaneous protective equipment.



LIGHTWEIGHT OPTICAL MASK has flat, adjustable eyepieces. It is worn by personnel using binoculars and other precision equipment. The canister is located in the carrier, which is slung under the left arm. Carrier and contents are the same as those for the lightweight service mask.

① *Masks are designed for various uses, but the principle of operation is the same.*

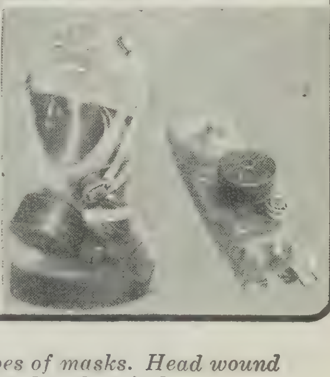
Figure 24. Types of gas masks.

TYPES OF GAS MASKS

SERVICE MASK was widely distributed before the combat and lightweight masks were developed, but it is being replaced by newer models. The carrier is usually worn under the left arm. The canister is fastened in the carrier and is connected to the facepiece by a hose.

SNOUT TYPE SERVICE MASK is designed for use by assault troops, such as armored troops, assault infantry, amphibious troops, and paratroops. It consists of a facepiece, canister, and carrier. The canister is attached to the front of the facepiece by means of a canister mounting adapter, no hose being used.

HEAD WOUND MASK is for personnel hospitalized with head wounds that prevent their using ordinary masks. It consists of a loose-fitting head covering made of transparent synthetic fabric, to which is connected an outlet valve and canister. The mask is stored in a transparent carrier.



(2) *Three additional types of masks. Head wound masks are issued to hospitals.*

less, or at least nonpoisonous. (Liquid screening smokes may cause burns to skin and clothing.) Enemy smokes, however, may be poisonous. When in doubt, the soldier should mask.

g. Incendiaries. These cause burns which are like any heat burns. Greater injury may result from detonation of high explosive delay charges mixed with incendiaries.

Section III. INDIVIDUAL DEFENSE AGAINST CHEMICAL AGENTS

93. GENERAL. a. Purpose. Individual defense measures include the actions the soldier takes to reduce the risk of injury to himself from chemical agents.

b. Types. The soldier has recourse to two types of individual defense measures.

(1) He may put on his personal protective equipment, which protects his eyes, nose, throat, lungs, and body.

(2) Within his own area, he may avoid gross contamination.

94. GAS MASK. a. Protection. The gas mask protects the soldier from war gas injury to the face, throat, and lungs.

b. Types. Several different types of gas masks have been designed for field conditions and special uses. (See figure 24① and ②). They are basically alike (figure 25) in that—

(1) A facepiece covers the eyes, nose, mouth, and face.

(2) When the wearer breathes in, the contaminated air is drawn through a canister where it is purified by certain chemicals and filters.

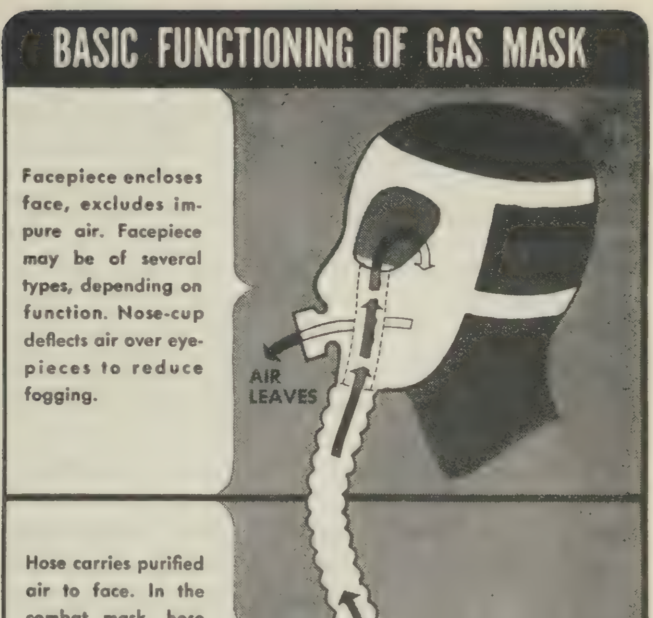


Figure 25. Basic functioning of gas mask.

(3) The purified air passes into a facepiece where it is breathed by the wearer.

(4) Exhaled air passes out through an outlet valve in the facepiece. The valve is made so that it allows air to escape but prevents air from entering.

Note. The service canister does not provide oxygen and does not protect against non-war gases such as ammonia and carbon monoxide. Individuals required to work where these gases are likely to be encountered, will be provided with special canisters designed to protect against these special gases. Head-wound gas masks are provided at medical installations for the protection of individuals whose wounds prevent the use of service masks.

c. Care. The soldier is responsible for proper care of his gas mask. He should inspect the mask frequently to insure that it is free from injury and in good working order. Any defect found will be reported immediately to an officer or noncommissioned officer. (The proper inspection procedure is shown in appendix VI.) Proper care means that the soldier must avoid:

(1) Unauthorized plugging of the inlet valve in the canister.

(2) Mashing, tearing, puncturing, denting, or breaking any part of the gas mask.

(3) Allowing the facepiece to develop a permanent or temporary crease.

(4) Plugging or curling of the outlet valve, or allowing it to become clogged with foreign matter. The valve should be cleaned when necessary.

(5) Allowing water to enter the canister.

(6) Using the mask as a pillow, cushion, or seat.

(7) Placing in the carrier any but the authorized items.

d. Fitting and adjustment. (1) Both proper fit and accurate adjustment of the gas mask must be secured to obtain adequate protection.

(2) The head harness straps can be adjusted to provide a gastight fit. They should be pulled evenly, but not so tight as to cause discomfort. The mask should then be snug but not tight. The standard size facepiece fits most soldiers, and special sizes exist for small or large faces. If the facepiece does not fit, another mask must be obtained.

(3) Proper withdrawal of the facepiece from the carrier, correct adjustment to the face. clearing of the facepiece, testing for gas, and removal of the facepiece and replacing it in the carrier require supervised drill and frequent practice.

(4) Wearing the gas mask for long periods may become necessary. During these periods, the soldier does his normal duties. This ability can only be acquired by frequent practice and proper fitting of the mask.

(5) Materials for waterproofing the canister may be issued with the mask, the type of waterproofing depending on the mask itself. For certain masks, a kit containing waterproofing materials is used. The lightweight service mask is issued with a clamp for the hose and a rubber cap for the canister inlet valve.

e. Speaking when wearing the mask. The voice is muffled when the mask is worn, but the voice can be heard through the regular mask over field

radios and telephones. Radio transmitters are held either in direct contact with or about 3 inches in front of the outlet valve, whichever gives best results. Telephone transmitters are held above and to the side of the outlet valve. The person on the other end of the line is informed that a mask is being worn.

95. PROTECTIVE CLOTHING. a. Types (figure 26.) (1) *Permeable protective (impregnated) clothing.* Permeable protective (impregnated) clothing is special clothing which has been chemically treated. It affords a high degree of protection against the vapors and fine spray droplets of blister gases, since such small amounts of gases are rendered harmless when they come in contact with the clothing. This clothing does not protect against large droplets or splashes of liquid blister gases which may come in contact with the clothing when the wearer walks through heavily contaminated weeds, tall grass, or brush, or during decontamination operations of blister gases in liquid form. This clothing is issued as individual equipment.

(2) *Impermeable protective clothing.* Impermeable protective clothing is a coated fabric coverall-type suit (including hood) which, when worn as shown in figure 26 affords complete protection to the wearer from the vapors and splashes of liquid blister agents. These liquid agents are shed by coated clothing in the same manner as rain is shed by a raincoat. During wear, body heat and moisture are held within the suit; consequently, it can only be worn for periods of approximately

Figure 26. Basic differences between the two types of protective clothing.

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one-half hour by actively working men. Men working in areas heavily contaminated with liquid blister agents should wear this type of clothing. Permeable protective long underwear is worn beneath the clothing. The impermeable protective clothing is issued as organizational equipment.

b. Classes of protection. Field protection for troops is classified into four groups, depending on the nature of the duties of the troops and the possible danger. These classes are as follows:

(1) *Class I.* Intended for individuals who will probably be in contact with the enemy when gas warfare starts. The clothing consists of the following: gas mask; impregnated long underwear; impregnated wool or cotton service uniforms or impregnated one- or two-piece cotton outergarment (HBT); impregnated hood, socks, leggings, and cotton gloves; and shoes or combat boots treated with shoe impregnite.

(2) *Class II.* Intended for individuals not in direct contact with the enemy, but subject to possible air or surprise attack. Clothing is the same as that listed in class I except that impregnated short drawers are substituted for long underwear.

(3) *Class III.* Intended for individuals not in contact with the enemy, against whom gas attack is very unlikely. Protection consists of gas mask and protective accessories in the carrier. Clothing is that which is ordinarily worn.

(4) *Class IV.* No protection except that offered by tactical measures; that is, getting out of or avoiding gassed areas.

c. Fitting and adjustment. (1) In the presence of gas, special attention should be paid to proper closure of all openings and flaps. Jackets should be tucked inside trousers, and sleeve cuffs should be tied with strings. Gauntlets should be drawn over sleeves.

(2) If drawers are too loose about the waist, they should be supported by tie strings.

(3) Hoods should be close fitting around gas mask eyepieces and outlet valve assemblies and should not pucker or gap in these areas.

(4) A better seal is obtained if the hood is tucked into the neck of the jacket. It should, however, be attached to the buttons on the back of the jacket until it is put on, since otherwise it may be lost.

(5) Protective ointment applied to ears and parts of face and neck not covered by the gas mask facepiece give extra protection to those areas.

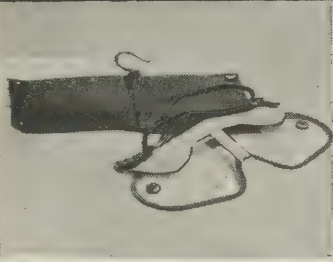
d. Points to remember. (1) Although two layers of permeable protective (impregnated) clothing protect against blister gas vapors, protection against visible liquid contamination is limited. Troops must avoid brushing against liquid contamination, or sitting or lying on contaminated ground.

(2) Troops should always inspect each other for visible contamination.

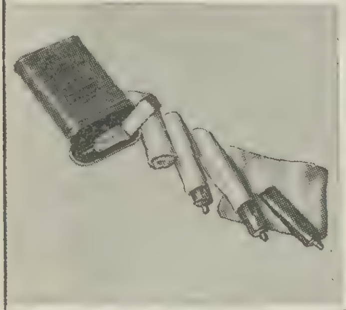
(3) Rain and sweat do not greatly impair the protection afforded by permeable protective (impregnated) clothing.

(4) Troops should not expect to be as comfortable in protective clothing as in ordinary clothing.

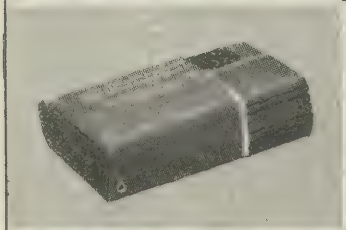
MISCELLANEOUS PROTECTIVE EQUIPMENT



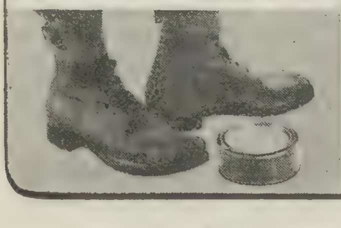
EYESHIELDS
Eyeshields protect the eyes from drops of liquid blister gas sprayed by airplane or splashed from munitions bursting close by. They should be worn at all times in the open when spray is likely. They are discarded when contaminated, before the soldier decontaminates his face (par. 100).



PROTECTIVE OINTMENT AND BAL
Prior to exposure: Protective ointment applied to exposed skin areas, and left on the skin as a visible film, protects against vapors of blister gas and affords some protection against liquid blister gas. *Do not place in or near eyes.*
For self aid: See paragraph 100. BAL ointment for eyes is also discussed there.



PROTECTIVE COVER
A protective cover fits over the crouching soldier like an inverted sack and shields his body, clothing, and equipment from blister gas spray attacks. The top of the cover is transparent. (See appendix VII for use and drills.)



SHOE IMPREGNITE
To prevent penetration of liquid blister gas, shoe impregnite is applied to footgear, with especial attention to the seams.

Figure 27. Miscellaneous protective equipment.

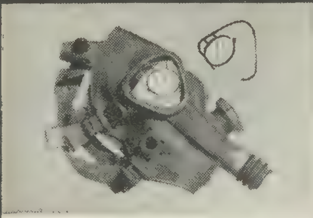
(5) Troops should be briefed in proper procedures for eating, drinking, sleeping, defecating, and urinating in gassed areas.

(6) Troops dressed in permeable protective (impregnated) clothing should avoid contact with bleach, alcohol, gasoline, and other solvents because they damage the clothing. Troops should always inspect the clothing for holes before and during wear.

e. Tests for protective value. Protective clothing is tested for its protective value by special personnel either in the field or at laundry installations.

96. MISCELLANEOUS PROTECTIVE EQUIPMENT. In addition to the gas mask and protective clothing, the soldier has the following items of equipment; eyeshields, protective ointment, protective covers, and shoe impregnite. These are shown and described in figure 27. He also has eye ointment (BAL) to be used for any liquid blister gas in the *eyes.* BAL is discussed in paragraph 100. Miscellaneous accessories are also furnished for the gas mask. (See figure 28.) The anti-dim cloth is used on gas mask eyepieces to prevent fogging. An outlet valve cover may be issued to fit over the outlet valve in cold weather to prevent freezing. During chemical warfare, special gas mask eyeglasses (a medical item of issue) may be issued to personnel who must always wear spectacles. These must be fitted to individual prescription and installed in the mask; consequently, the inserts should be removed when the mask is replaced.

MISCELLANEOUS GAS MASK ACCESSORIES



GAS MASK EYEGLASSES are available for personnel who must always wear spectacles. They fit inside the facepiece.

OUTLET VALVE COVER is a "stocking cap" that fits over the outlet valve. It is used in extremely cold weather to prevent the outlet valve from freezing.

ANTI-DIM CLOTH is used on eyepieces to reduce fogging.

GAS MASK WATERPROOFING KIT is used to protect the gas mask in landing operations. Waterproofing can be removed speedily. A cap and clamp are attached to the lightweight service mask.

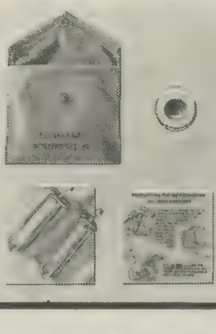


Figure 28. Miscellaneous gas mask accessories.

Copper sulfate pads are discussed in paragraph 100.

97. CARE OF EQUIPMENT. The soldier is responsible for proper care of his gas protective equipment. Any defective (or missing) items should be reported immediately and replacements secured. Proper care of equipment includes frequent inspections.

98. AVOIDANCE OF GAS. In addition to the security he gains from his protective equipment, the soldier, on orders, may seek security in a change of position within his own area. In a gas attack, *if his mission* and the hazard from other enemy weapons permit, he may seek security in the following places:

a. Upwind areas. The soldier seeks an upwind area free from gas.

b. Higher areas. The soldier may move to higher ground or to upper parts of a building if these areas are not contaminated. Vapors are likely to be more diluted in higher places.

c. Gasproof shelters. The soldier may go to a gasproof inclosure. Gasproof shelters for command posts, medical aid, resting, and eating should be used for these purposes only, however.

Section IV. SELF-AID PROCEDURES

99. GENERAL. a. Purpose. When the equipment outlined in paragraphs 93 through 98, is properly used, it protects the soldier from injury by chemical agents. Individual defense measures may fail, however, because of damaged equipment; or such measures may not be taken quickly enough be-

cause of surprise or other battle conditions. Under such circumstances, aid may still save the soldier from injury. Self-aid includes those measures which a soldier carries out for himself in order to minimize or avoid injury from chemical agents.

b. Types. The self-aid procedures outlined in this section include only the measures to be taken by the individual in combat, with the equipment normally available to him. Speed is always essential. The types of self-aid in which the soldier is trained, therefore, have been reduced to the minimum. In general, they are based on recognition of the groups of chemical agents defined in paragraphs 89 through 92.

100. COMBAT SELF-AID PROCEDURES. a. For liquid blister gas in eyes. (1) Rub BAL OINTMENT (figure 27) well into and around the eye for 1 minute. (If the eye cannot be opened because of pain, rub BAL on the slit between the lids until the pain is reduced and the eye can be opened.)

(2) Hold the eye open and flush with water from the canteen (or from other uncontaminated source) for at least 30 seconds.

Caution: Never use *protective ointment* in or close to the eyes. The soldier's tube of BAL ointment is for the *eyes.* Protective ointment is for the *skin.*

b. For liquid blister gas on the skin. (1) If the clothing is heavily contaminated, remove it.

(2) Pinch-blot the visible liquid. (Use the gauze which comes with tube of protective ointment. *Do not rub the liquid into the skin.* Discard the gauze.)

(3) Rub in protective ointment for 30 seconds, wipe off the excess with clean gauze, apply fresh ointment and allow it to remain as a visible film. The sooner the ointment is applied the better.

(4) Do not apply ointment if the skin is red or blistered.

Note. In self-aid for liquid blister gas, the soldier should be trained always to follow this sequence:

1. The *eyes* must be cared for first.
2. The *hands* next.
3. Then *face, neck,* and *ears.*
4. The *mask* is adjusted.
5. The *skin* and *clothing* are then decontaminated (Clothing should be cut away and discarded if heavily contaminated.)

c. For blister gas vapor. (1) Protection is the best means of avoiding injury.

(2) If exposed in ordinary clothing, remove and aerate it.

d. For any gas in cloud or vapor form. (1) Put on mask and continue with the mission.

(2) If disabled because of choking gas, lie down and keep quiet until evacuated.

(3) If vomiting occurs, pull the mask away from chin during vomiting periods, replacing it immediately. The mask must not be removed, even if the symptoms grow worse. After leaving the area, wash eyes, nose, mouth, and throat with water.

(4) Some gases first cause headache and dizziness. Certain blood and nerve poisons may cause unconsciousness in less than 2 minutes. (See first-aid procedures, figure 8.) Inhale amyl nitrite (if available) by crushing 2 ampoules and

placing them inside the gas mask near the mouth. Repeat at 3- to 4-minute intervals until 8 ampoules are inhaled. (Amyl nitrite ampoules will be furnished the individual prior to gas warfare.)

Note. If breathing has ceased, artificial respiration must be administered.

e. For tear gas on skin or in eyes. (1) If liquid or solid particles get into the eyes, wash the eyes immediately with water from the canteen.

(2) Do not rub eyes. The effect is temporary. Put on the mask.

(3) Wash liquid off the skin with soap and water, or with water only.

f. For white phosphorus burns. (1) Douse the burn with canteen water. Wet the copper sulfate pad with canteen water.

(2) Press the wet pad directly onto the white phosphorus particles. Then squeeze liquid onto the burned area.

(3) Carefully pick out the particles of white phosphorus from the skin with a knife, bayonet, match stick, or gently rub them out with the pad itself.

(4) Discard the pad. Do not use it for a dressing after the particles have been removed.

(5) Do not use greases or ointments. Poisoning may result.

Note. Burns from other incendiaries are dealt with like ordinary heat burns.

g. For smokes. (1) Mask when exposed in confined spaces, when close to the point of release, or during prolonged exposure.

(2) Consider enemy smokes dangerous until proved otherwise.

Section V. EMERGENCY DECONTAMINATION OF PERSONAL EQUIPMENT

101. INTRODUCTION. In emergencies, the soldier may be called upon to perform any or all of the personal decontamination measures described in this section. He may be called upon to act as a member of a decontamination team where large areas or large equipment are involved, but the procedures and techniques used are ordinarily explained to him at that time by supervising officers or noncommissioned officers.

102. PROTECTIVE OINTMENT FOR EMERGENCY DECONTAMINATION. Emergency decontamination of clothing and certain equipment may be accomplished with protective ointment, as follows. (See figure 29.)

a. Clothing, lightly contaminated. Use ointment as an expedient until clothes can be changed. Apply to both sides of cloth. Rub in thoroughly, with special attention to seams. This method is practical only for very small areas.

b. Weapons. Blot all liquid blister gas and burn or bury blotting material when practicable. Spread ointment over all metal, wood, and leather surfaces which appear contaminated. Rub in well and permit ointment to remain 15 minutes; then wipe all surfaces dry. Later disassemble weapon, clean it thoroughly, and oil all parts.

c. Intrenching tools. Scrape off contaminated earth or other material; then apply ointment to all contaminated surfaces except the blade. Leave ointment 15 minutes; then wipe it off. Decontaminate

the blade by plunging it repeatedly into uncontaminated soil, or by washing it with water.

d. Leather. Blot all surfaces dry; then coat with ointment (within 3 minutes). Rub ointment in well; leave for 15 minutes; then wipe it off.

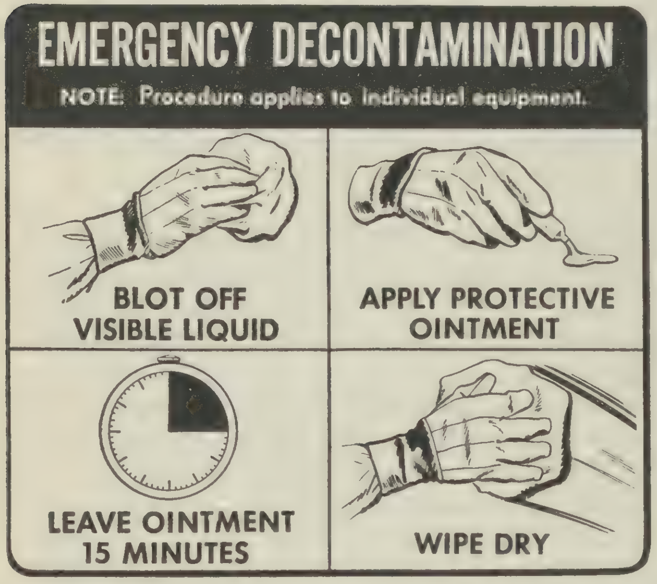


Figure 29. Emergency decontamination with protective ointment.

e. Canvas webbing. Decontaminate like clothing. (See a above.)

f. Gas mask. Ointment can be used on facepiece and hose only. (Most practical methods of decontaminating a carrier are aeration or scrubbing with soap and water.) Procedures for facepiece and hose are:

(1) *Facepiece.* Blot liquid blister gas; then coat affected areas with ointment, preferably within 3 minutes. Permit ointment to remain 15 minutes, then wipe it off; be sure valves and interior surfaces are wiped dry. Repeat this procedure daily until mask can be decontaminated by other means.

Warning: Do not place ointment on the eyepieces; instead, rub them with a dry cloth or absorbent paper, next with a damp cloth, then dry them, allow to aerate for 24 to 48 hours, and finally wipe with anti-dim cloth.

(2) *Hose.* Apply ointment immediately to outside surfaces only. It is impractical to decontaminate a heavily contaminated hose with ointment; liquid blister gas is quickly absorbed by the hose and produces vapors within.

103. CLOTHING AND GAS MASK. *The gas resistent sack* is used for shipping contaminated clothing to designated decontaminating points. In emergencies, field decontamination of clothing is accomplished as follows:

a. Ordinary clothing. Ordinary clothing is decontaminated by laundering with warm soapy water, by subjecting garments to hot air, or by exposing them to aeration and sunlight for several days. Hot water and steaming shrink woolen clothing.

b. Permeable protective (impregnated) clothing. Permeable protective (impregnated) clothing is laundered by standard methods. It must not be dry cleaned. Water for washing must be *warm,* not *hot* (lukewarm for woolen garments). Aeration is satisfactory for lightly contaminated clothing;

more time is needed for aeration in cold weather than in warm.

c. Impermeable protective clothing. Impermeable protective clothing is destroyed if heavily contaminated. Moderately contaminated garments are aerated, or may be immersed in water just under boiling until blister gas odor is gone. Damage from such immersion is readily visible. Damaged garments are salvaged.

d. Shoes. Shoes are soaked 4 hours in water about as hot as the hand can stand, followed by drying and application of dubbing, or shoe impregnite under conditions of gas warfare.

Section VI. GAS DUTIES OF SENTINELS

104. GENERAL. All sentinels have duties in connection with defense against chemical attack. If necessary, special gas sentinels are posted at gasproof shelters and in other locations where special sentinel duties are required, but all sentinels should be instructed in chemical defense duties as prescribed in this section. The gas alarm is given not only by the sentinel, however, but also by any individual who detects war gas.

105. DUTIES AND TYPES OF GAS ALARMS. Two different types of gas alarms are given by the sentry—one for airplane spray attack, and one for all other methods of attack.

a. Alarm for spray. If the attack is by airplane spray, only the warning cry of "SPRAY!" is given. It should be given only when attacking aircraft are actually observed to begin a *spray* attack. The sentry then—

(1) Adjusts his protective cover and masks.

(2) Follows SOP for defense against air attack (if firing, thrusts rifle or carbine forward through top corner of protective cover, appendix VII).

(3) Resumes normal sentry duties.

b. Alarm for other types of gas attack. If the gas attack is by any other method, the sentry—

(1) Shouts "GAS!"

(2) Sounds the percussion alarm for a period of 15 seconds, holding his breath, if necessary.

(3) Adjusts his mask.

(4) Resumes sounding the percussion alarm for 1 minute.

(5) Awakens all personnel in the vicinity of his post.

(6) Resumes normal sentry duties, but does not remove mask until "all clear" order is given, or until the area is shown by test to be gas-free.

106. SPECIAL SENTINELS. Sentinels posted at gas-proof shelters and at supply points should be briefed in any additional techniques required by their special duties.

Section VII. INCENDIARY CONTROL

107. METHODS. In fighting incendiaries, soldiers should remember that high explosive may be present. The following are emergency defense measures—

a. Burning metals. Water extinguishes these munitions with difficulty, but it speeds up the burning, and water surrounding the area of the burning metal prevents fire from spreading. Sand or

earth is effective in confining the damage. The munition is shoveled into a pail or box of sand or earth, covered with additional sand or earth, and allowed to burn on a nonflammable surface. The munition burns for several minutes. At night, out-of-doors, the munition is covered with sand or earth to destroy its effectiveness as a ground flare. A soldier attempting to control the munition should shield himself as much as possible. Fragments of explosive incendiaries have been known to penetrate a brick wall. Burns may require attention at an aid station.

b. Oil incendiaries. Sand, earth, or special fire extinguishers put out an oil or gasoline fire. The carbon dioxide extinguisher with the funnel-type nozzle is very effective, since it blankets and smothers the fire. Soda-acid fire extinguishers are not used directly on oil fires, and the pyrene-type extinguisher may generate toxic fumes in confined places.

c. White phosphorus. Water extinguishes burning phosphorus, but unconsumed particles burn again when the water has evaporated. Unburned particles are buried or placed in water not used for other purposes.

Section VIII. TRAINING OUTLINES

108. GENERAL. a. Doctrine. The training doctrine set forth in FM 21–5 and the methods prescribed in TM 21–250 apply with especial force to training in defense against chemical attack. In arranging practical training exercises, TM 3–305 should be consulted.

Note. Instructors should strive to give the soldier a respect for chemical agents, but should not instill fear into him.

b. Training methods. Methods of presenting each subject may vary with the instructor, training material available, and the mission of the command. Contents of the following paragraphs, therefore, are to be looked upon as a guide for training to the extent determined by policies of the unit commander. They are to be augmented or curtailed as the situation requires.

c. Periods of instruction. The instruction required by the individual soldier may be broken into successive periods as follows, each lasting 50 minutes:

Period	Subject	Reference	Uniform
1	Orientation	Par. 88.	Service.
2	Chemical agents; characteristics, detection, and effects	Pars. 89, 90, 91, 92.	Do.
3	Individual defense measures and equipment	Pars. 93, 94, 95, 96, 97, 98.	Do.
4	Gas mask and protective cover	Pars. 94, 96.	Do.
5	Gas mask drill	App. VI.	Do.
6	Gas chamber exercise	TM 3–305.	Fatigue.
7	Self-aid measures	Pars. 99, 100.	Do.
8	Decontamination of personal equipment	Pars. 101, 102, 103.	Service.
9	Gas duties of sentinels	Pars. 104, 105, 106.	Do.
10	Incendiary control	Par. 107.	Fatigue.

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109. FIRST PERIOD: ORIENTATION. **a. Presentation.** (1) Explain briefly the distinguishing features of chemical warfare, the reasons for its existence, and how it fits into the general scheme of warfare.

(2) Give and discuss the standards of proficiency listed in paragraph 88. Letter the standards on flash cards and display one at a time.

(3) In a general way, explain the standards and what they entail.

(4) Use the instructional gas identification set M1 to give soldiers examples of war gas odors. No attempt should be made to have soldiers identify an individual war gas by its odor, but the odors are presented as examples of major physiological groups, such as blister gases, choking gases, or vomiting gases.

(5) If possible, show a small amount of liquid blister gas, exercising precautions to prevent injury.

b. Training aids and references. Flash cards, instructional gas identification set M1, and TM 3–305.

110. SECOND PERIOD: CHEMICAL AGENTS. **a. Presentation.** (1) Explain the points in paragraphs 89 and 90.

(2) By means of the exercise in TM 3–305, use the detonation gas identification set M1 to give soldiers field experience with war gas odors. Do not attempt to have soldiers identify the separate gases, but present odors as examples of physiological groups as above. The odor should be remembered but not the name of the individual war gas.

(3) Show the blister gas in its container to indicate its color.

(4) With reference to paragraph 91, show how chemical agents behave.

(5) Explain the material in paragraph 92.

(6) If possible, use at least a WP grenade and an HC smoke pot to indicate the different types of smokes and smoke munitions.

b. Training aids and reference. TM 3–305, flash cards, detonation gas identification set M1, and toxic gas set M1.

III. THIRD PERIOD: INDIVIDUAL DEFENSE MEASURES AND EQUIPMENT. a. Presentation. (1) Prepare for lesson by obtaining a gas mask of the type with which the unit is equipped, complete with BAL and protective ointment, eyeshields, protective covers, anti-dim, and waterproofing accessories (clamp and rubber cap tied to mask). Also needed are two assistants, one dressed in a set of permeable protective (impregnated) clothing and the other in a set of impermeable protective clothing. Shoes or combat boots and a can of shoe impregnite are necessary. Pertinent charts in GTA 3–1 may be used.

(2) Explain briefly paragraph 93.

(3) Explain that each man is responsible for his own protection against gas, that he has the necessary equipment, and that he must learn to use and care for it.

(4) Show the gas mask and explain how it works. Point out that when the mask fits, is adjusted properly, and is in serviceable condition, it affords complete protection against all war gases

for the eyes and breathing passages. Proper fitting, waterproofing, and drills, are to be shown in a subsequent period.

(5) Take up each of the points in paragraphs 94 and 96.

(6) Show and explain items in the gas mask carrier. Indicate where each is placed. Point out that—

(a) Eyeshields are worn to prevent liquid gas from entering eyes. Eyeshields must be properly adjusted in the open where spray attacks may be expected.

(b) Protective ointment may be used for protection prior to exposure to blister gas vapor, as well as for self-aid after liquid contamination. Explain protective use, leaving aid for subsequent self-aid lesson. Reserve BAL eye ointment for same lesson. Give directions for applying ointment, and have soldiers apply it. Caution that ointment should be kept out of eyes.

(c) Protective cover is used for protection against airplane spray. Show how it is adjusted and used. Drill is shown in a later period.

(d) Anti-dim cloth is used to prevent fogging of gas mask eyepieces. Explain application.

(7) Show and explain the two types of protective clothing, using the demonstrators. Explain the points in paragraph 95.

(8) Show and explain application of shoe impregnite.

(9) Explain that the soldier is responsible for proper care of his equipment. (See paragraph 97.)

b. Training aids and references. Lightweight service gas mask, complete with items authorized in carrier, including eyeshields; pertinent charts in GTA 3–1; protective clothing and demonstrators; and combat boots or shoes and shoe impregnite.

112. FOURTH PERIOD: GAS MASK AND PROTECTIVE COVER. a. Presentation. (1) Remind students that the gas mask gives complete protection to the eyes and breathing passages against all war gases, provided it is well-fitted, well-adjusted, and in serviceable condition. Point out that—

(a) When gas is used, adjusting the gas mask may not give immediate relief. The soldier may believe that his mask is ineffective, but he must resist the temptation to remove it.

Note. Instructors should explain that symptoms from vomiting gases sometimes persist and even grow worse after the mask is put on.

(b) The protection afforded by the mask is effective for all known war gases. Masks with special canisters are issued when necessary. The service canister does not protect against gases in engine exhausts, ammonia, and other industrial gases. The headwound mask is used in hospitals and elsewhere when headwounds prevent use of the service mask.

(2) Using GTA 3–5, name the parts of the mask, explaining the function of each part. Use GTA 3–4 to show the airflow of the mask.

(3) Remind students of the rules for care and use of the gas mask. (See paragraph 94.)

(4) Demonstrate how to adjust and remove the mask.

(5) Show how to use the waterproofing cap and clamp, or set.

(6) Show the protective cover; explain and demonstrate its use, and have soldiers practice. For use and drills, see appendix VII.

b. Training aids and references. Gas mask issued to unit, protective covers, appendix VII, GTA 3–4, and GTA 3–5.

113. FIFTH PERIOD: GAS MASK DRILL. a. Presentation. (1) Using the mask with which the unit is equipped, demonstrate and explain the various carrying positions set forth in appendix VI. Illustrate with demonstrators.

(2) Have students sling masks and adjust body straps.

(3) Conduct drills with the aid of trained assistants. (Drills are set forth in appendix VI.) Point out that—

(a) Good adjustment is most important.

(b) In masking, students should habitually stop breathing on hearing alarm.

(c) Soldiers should practice putting on the mask while in a prone position.

(d) Personnel should always test for gas before removing masks.

(e) Stress the points in paragraph 94e.

(4) With aid of assistants, check fit of each facepiece, adjusting where necessary.

(5) Check students on proper adjustment.

(6) If more than 1 hour is available for drills, the first one-half hour may be used profitably for drill "by the numbers" and in fitting facepieces. (Interest can be heightened by elimination con-

tests, prone drills, and other devices.) The second hour or additional hours may be used for a hike better to determine individual fittings.

b. Training aids and references. Appendix VI and TM 3–205.

114. SIXTH PERIOD: GAS CHAMBER EXERCISE. a. Presentation. (1) Explain the purpose of the exercise. (See paragraph 3, TM 3–305).

(2) Follow procedure outlined in detail in TM 3–305.

b. Training aids and references. TM 3–305 and the complete materials for conducting gas chamber exercise as outlined in TM 3–305.

115. SEVENTH PERIOD: SELF-AID MEASURES. a. Presentation. (1) Explain material in paragraph 99.

(2) Name the groups of war gases (blister gases, choking gases, etc.), telling soldiers that self-aid for these and for white phosphorus burns must be learned by practice.

(3) Explain and demonstrate the self-aid measures given in paragraphs 100a, b, and c. Stress that the proper sequence is important, especially in self-aid for blister gases.

(4) Show how to flush eyes with water from canteen, tilting head back, holding lids back with fingers, holding finger over canteen mouth, and pouring slowly.

(5) Have soldiers perform each step, using coach and pupil method.

(6) Show how copper sulfate pads are used.

(7) Stress that speed is essential in all self-aid.

b. Training aids and references. Individual first-aid items, extra absorbent cloth or paper, and demonstrators.

116. EIGHTH PERIOD: DECONTAMINATION OF PERSONAL EQUIPMENT. **a. Presentation.** (1) Explain material in paragraphs 101 and 102.

(2) Explain and demonstrate how to use protective ointment for emergency decontamination of clothing.

(3) Do the same with weapons and other personal equipment.

(4) Instructor's note: If time is available, vehicle and area decontamination may be taught in a second hour. Actual blister gas may be used to contaminate several vehicles or areas. (See paragraphs 16 through 21, TM 3–305.) Students are formed into teams and given practice in actual decontamination. Special decontamination may be taught to special units, depending upon the unit and its equipment (that is, motor maintenance personnel and gun crews).

b. Training aids and references. For personal decontamination, procure several tubes of protective ointment and materials to be contaminated. If team decontamination is taught, see TM 3–305 for exercises.

117. NINTH PERIOD: GAS DUTIES OF SENTINELS. **a. Presentation.** (1) Explain gas duties of sentinels as prescribed in paragraphs 104 and 105. The use of large lettered cards setting forth these duties may prove helpful.

(2) Distinguish carefully between the two different types of gas alarm given.

(3) Show and sound the M1 gas alarm. Point out that substitutes may be used in the absence of the M1 alarm. These substitutes may be empty shell cases, lengths of pipe, or brake drums.

(4) Employing coach and pupil method, have students practice the procedures outlined in paragraphs 105a and b.

b. Training aids and references. TM 3–290 and M1 gas alarm, empty shell cases, or other alarm devices.

118. TENTH PERIOD: INCENDIARY CONTROL. a. Presentation. (1) Demonstrate how a thermate incendiary bomb or grenade burns through steel. Caution students that these are often mixed with high explosive delay charges.

(2) If possible, show a small oil incendiary bomb and explain how it bursts, throwing flaming particles which start fires.

(3) Explode a WP grenade.

(4) Demonstrate how to control each of the three kinds of incendiary bombs. (See paragraph 107.) Have students participate.

(5) Caution students that certain pyrene types of fire extinguishers generate toxic gases in closed spaces, and that a stream of water placed directly on an oil fire tends to spread the fire. The carbon dioxide extinguisher is effective for oil fires. WP re-ignites spontaneously unless kept covered with water or buried.

(6) Instructor's note: Exercises in paragraphs 45 through 51, TM 3–305, may prove useful.

b. Training aids and references. Instructional incendiary bombs (paragraphs 45 through 51, TM 3–305), sand and shovels, fire extinguishers, steel sheet or plate on platform. TM 3–300, and TM 3–305.

CHAPTER 10

DUTIES AND TRAINING OF ALL OFFICERS AND NONCOMMISSIONED OFFICERS

Section I. DUTIES

119. GENERAL. Chemical defense duties of the troop officers and noncommissioned officers of the unit include the following:

a. Training. They train the individual and the unit in individual, collective, and tactical chemical warfare defense measures. Unit gas personnel may supervise or assist in such training.

b. Combat. In operations, troop officers and noncommissioned officers prescribe and supervise collective and tactical defense measures for their units. They know how to use organizational first-aid equipment and detection devices. The degree to which officers and noncommissioned officers are trained in such measures is shown in paragraph 122.

Section II. TRAINING OUTLINE

120. GENERAL. Unit gas officers, aided by unit gas noncommissioned officers, should conduct the gas defense training of troop officers and noncommissioned officers. The following outline is presented only as a *guide* to be used as the commander may direct. The outline may be adapted, curtailed, or enlarged, depending upon the mission of the unit. References listed under "texts and training aids" are not meant to be used in their entirety. Instructors should select only such paragraphs as are pertinent to the mission of the unit

and to the degree of training required. FM 21-6 should be consulted for latest references.

Note. For a flow chart of chemical warfare supplies, see figure 34.

121. SUBJECT.

	Hours
a. Training methods and aids and supplies for training	2
b. Individual soldier course (taught to students)	10
c. Individual soldier course (practice teaching and critique by students)	10
d. Tactical employment and field behavior of chemicals	2
e. Collective protection	4
f. Organization and supervision of decontamination personnel	2
g. Tactical protection	5
h. Chemical intelligence collection of information	1
i. Chemical offensive and defensive materiel, flow of supplies, and basis of issue	2
j. Organizational first-aid kit	2
k. Gas detection devices	2
Total	42

122. TRAINING OUTLINE. **a.** Training methods and aids and supplies for training .... 2 hours

(1) *Scope.* Principles of Army instruction as applied to training in security against chemical attack, training aids, and supplies.

(2) *Texts and training aids.* FM 3-5, 3-6; TM 21-250; TF 7-295.

b. Individual soldier course (taught to students) ....10 hours

(1) *Scope.* Outlined in paragraphs 87 through 118.

(2) *Texts and training aids.* Listed in paragraphs 87 through 118.

Note. The individual soldier course is taught to troop personnel by unit gas officers or unit gas noncommissioned officers (with emphasis upon teaching technique) to demonstrate how the periods are to be presented.

c. Individual soldier course (practice teaching and critique by students) .... 10 hours

(1) *Scope.* Outlined in paragraphs 87 through 118.

(2) *Texts and training aids.* Listed in paragraphs 87 through 118.

Note. Students will present practice teaching demonstrations of selected periods of the individual soldier's course. Fellow students and other available personnel may be used as practice students and to critique the presentations.

d. Tactical employment and field behavior of chemicals .... 2 hours

(1) *Scope.* Smoke munitions and the tactical use of smoke in small scale tactical situations; tactical uses of war gases by the enemy; influence of weather and terrain on the field behavior of chemicals.

(2) *Texts and training aids.* Paragraphs 29 through 36; FM 3–5; TM 3-240, 3–300, 3–305; GTA 3-1; FS 3–24.

e. Collective protection .... 4 hours

(1) *Scope.* Gasproof shelters, ventilated and unventilated; use and capacity; gas alarm systems;

protection of supplies and equipment, food and water.

(2) *Texts and training aids.* Paragraphs 41 through 66; TM 3–350; TF 3–1164.

f. Organization and supervision of decontamination personnel .... 2 hours

(1) *Scope.* Organization and supervision of decontamination personnel for decontamination of areas, unit equipment, and materiel.

(2) *Texts and training aids.* Paragraphs 41 through 66; TM 3–220; TF 3–1407.

g. Tactical protection .... 5 hours

(1) *Scope.* Chemical reconnaissance, posting gas areas; selection of bivouac areas and routes and methods of passage through contaminated areas.

(2) *Texts and training aids.* (See paragraphs 67 through 86.)

h. Chemical intelligence: collection of information .... 1 hour

(1) *Scope.* Collection of data relative to chemical warfare intelligence.

(2) *Texts and training aids.* (See paragraphs 74 through 77.)

i. Chemical offensive and defensive materiel, flow of supplies, and basis of issue .... 2 hours

(1) *Scope.* Explosives, chemical land mines, firing of chemical munitions; chemical munitions, and weapons for projecting chemical agents. The flow of supplies is shown in figure 34.

(2) *Texts and training aids.* Paragraphs 29 through 36; FM 3–5, 23–92; TM 3–300; GTA 3–1. This subject is to be discussed with reference to the Table of Organization and Equipment of the unit con-

cerned. See also WD Catalog QM 4 and WD Catalogs CW 3 and CW 4–1.

j. Organizational first-aid kit .... 2 hours

(1) *Scope.* Use of items in gas casualty first-aid kit.

(2) *Texts and training aids.* Paragraph 61; FM 21–11; TM 3–290, 8–285; GTA 3–2; gas casualty first-aid kit.

k. Gas detection devices .... 2 hours

(1) *Scope.* Use of gas detection devices.

(2) *Texts and training aids.* Paragraphs 42, 43, and 44; FS 3–31; GTA 3–1.

CHAPTER 11
DUTIES AND TRAINING OF UNIT GAS PERSONNEL

Section I. DUTIES

123. GENERAL. a. Combat. Unit gas officers and unit gas noncommissioned officers should be able to aid and advise the unit commander in any situation in which the enemy employs chemical agents. They are trained for their operations duties in special schools conducted by the chemical officer of divisions or higher echelons.

b. Training duties. Unit gas personnel conduct the chemical defense training of unit troop officers and noncommissioned officers. They also may be required to train the individual soldier and the unit, or to supervise and advise in such training.

124. SPECIFIC DUTIES. Duties of the unit gas officer fall into four major groups: training and inspection, defense measures, intelligence, and supply. (For flow chart of requisitions and supplies, see figure 34.) The unit gas noncommissioned officer is charged with aiding the unit gas officer, and in general his duties are identical.

a. Training and inspection. The unit gas officer:

(1) Trains unit troop officers and noncommissioned officers in chemical defense measures.

(2) Assists in the chemical defense training of his unit (or supervises and conducts such training, as the commander may direct).

(3) During tactical situations, assists in checking gas discipline.

(4) In conjunction with unit medical personnel, assists in supplying first aid to gas casualties, using gas casualty first-aid kit.

(5) Supervises or assists in the training of special decontamination squads, if such squads are necessary.

(6) When required, assists during regular inspections to determine whether personnel are properly trained in chemical protection and whether protective equipment is in good working order; advises in the care of protective equipment.

(7) Assists in training with flame throwers and preparation of flame-thrower fuels. (See FM 21–6 for list of pertinent manuals.)

b. Defense measures. The unit gas officer:

(1) Prepares the unit SOP for defense against chemical attack.

(2) Advises unit commander regarding weather conditions, routes of march, passage through contaminated terrain, and terrain favorable to enemy chemical attack, and makes plans for defense in case of such attack.

(3) Recommends collective defense measures, including protection of food and equipment; posts sentinels at shelters, over sleeping men, and with working parties; aids in the construction of gasproof shelters.

(4) Suggests methods of dealing with contaminated areas and equipment. (Posts sentinels or warning signs around such areas, and supervises decontamination if directed or needed. See TM 3–220.)

(5) Knows how to use the gas casualty first-aid kit.

c. Intelligence. The unit gas officer:

(1) Obtains information on enemy chemical warfare activities (including reconnaissance of gassed areas).

(2) Helps identify enemy chemical agents and warns of times favorable for attack.

(3) Posts the gas situation map or maps kept by the unit's staff.

(4) Investigates chemical attacks for unit S–2, and reports to S–2 and to division chemical officer. (Reports are made on form shown in figure 23.)

(5) Forwards information on captured enemy supplies to S–2. A copy goes to the division chemical officer. (When an unexploded bomb or shell is suspected of containing unidentified chemical agent, its location is noted so Ordnance personnel may be requested by higher headquarters to disarm it. Chemical warfare troops then dispose of it. It may be sent to a chemical laboratory company for analysis.)

(6) Informs lower units regarding the chemical situation.

d. Supply. The unit gas officer:

(1) Maintains contact with unit supply officer and advises unit commander regarding quantity and condition of chemical warfare supplies.

(2) May be asked to help unit supply officer see that chemical warfare supplies are properly prepared for movement.

(3) Through unit supply officer, supervises maintenance of all chemical warfare equipment, including repairs which can be made within the unit.

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Section II. TRAINING OUTLINE

125. GENERAL. Unit gas officers and unit gas non-commissioned officers are trained at special chemical defense schools conducted by division or higher echelons, and the specific programs for training are determined at such schools. The following training outline, therefore, is to be considered a guide only. References given under "texts and training aids" are not necessarily meant to be used in their entirety, and the degree of training should be determined by the particular situation. FM 21–6 should be consulted for the latest references.

126. SUBJECTS.

	Hours
a. Training methods and aids and supplies for training; programs, supervision, and inspections	8
b. Individual soldier course (practice teaching and critique by students)	10
c. Tactical employment and field behavior of chemicals	4
d. Collective protection	4
e. Decontamination, methods, equipment, and organization	8
f. Tactical protection	6
g. Supply, maintenance, and repair	4
h. Chemical intelligence	4
i. Chemical offensive and defensive materiel	4
j. Organizational first aid	2
k. Detection devices	6
Total	60

127. TRAINING OUTLINE. a. Training methods and aids and supplies for training; programs, supervision, and inspections .... 8 hours

(1) *Scope.* Principles of Army instruction as applied to training in defense against chemical attack, training aids, and supplies; unit school program preparation; supervision and inspection of training.

(2) *Texts and training aids.* FM 3–5, 3–6; TM 21–250; TF 7–295.

b. Individual soldier course (practice teaching and critique by students) .... 10 hours

(1) *Scope.* Outlined in paragraphs 87 through 118.

(2) *Texts and training aids.* Listed in paragraphs 87 through 118.

Note. Students should present practice teaching demonstrations of the 10 periods of the individual soldier's course. Fellow students and other available personnel may be used as students and to critique the presentations.

c. Tactical employment and field behavior of chemicals .... 4 hours

(1) *Scope.* Smoke munitions, the tactical use of smoke munitions, and the tactical use of smoke in small scale tactical situations; tactical uses of war gases by the enemy; influence of weather and terrain on the field behavior of chemicals.

(2) *Texts and training aids.* FM 3–5, 3–6, 3–50; TM 3–240, 3–300, 3–305; GTA 3–1; FS 3–24.

d. Collective protection .... 4 hours

(1) *Scope.* Gasproof shelters, ventilated and unventilated; construction and preparation, operation, use, and capacity; gas alarm systems; pro-

tection of supplies and equipment and food and water.

2) *Texts and training aids.* Paragraphs 41 through 66; TM 3–350; TF 3–1164.

e. Decontamination: methods, equipment, and organization .... 8 hours

(1) *Scope.* Organization and supervision of decontamination squads for decontamination of areas, unit equipment, and materiel.

(2) *Texts and training aids.* Paragraphs 41 through 66; TM 3–220; TF 3–1407.

f. Tactical protection .... 6 hours

(1) *Scope.* Chemical reconnaissance, posting gassed area; selection of bivouac areas, routes, and methods of passage through contaminated areas; advice to unit commanders on tactical protection and preparation of chemical defense plan.

(2) *Texts and training aids.* (See paragraphs 67 through 86.)

g. Supply, maintenance, and repair .... 4 hours

(1) *Scope.* Allowances of protective equipment, training supplies and munitions; supply procedures; care, inspection, disinfection, and repair of protective equipment.

(2) *Texts and training aids.* Figure 34; TM 3–205; WD Catalog QM 4, CW 3, CW 4–1; representative Tables of Organization and Equipment and Tables of Allowances, with especial reference to the Table of Organization and Equipment of the unit concerned.

h. Chemical intelligence .... 4 hours

(1) *Scope.* Collection of data relative to chemical warfare intelligence; preparation of reports;

channels of information; and duties of unit gas officers relative to S–2 and chemical staff officer, including maintenance of gas situation map.

(2) *Texts and training aids.* (See paragraphs 74 through 77.)

i. Chemical offensive and defensive materiel .... 4 hours

(1) *Scope.* Explosives and the firing of chemical munitions; chemical munitions and weapons for projecting chemical agents.

(2) *Texts and training aids.* FM 3–5, 21–40, 23 92; TM 3–300; GTA 3–1.

j. Organizational first aid 2 hours

(1) *Scope.* Use of items in gas casualty first-aid kit.

(2) *Texts and training aids.* Paragraph 61; FM 21–11; TM 3–290; 8–285; GTA 3–2; gas casualty first-aid kit.

k. Detection devices .... 6 hours

(1) *Scope.* Use of the M9 detector kit. detector paper, paint, and crayon.

(2) *Texts and training aids.* Paragraphs 42, 43, and 44; TM 3–290; M9 detector kit; FS 3–31; GTA 3–1.

CHAPTER 12
DUTIES AND TRAINING OF THE CHEMICAL OFFICER

Section I. FUNCTIONS AND DUTIES

128. RELATIONSHIP TO COMMANDER. a. General. The staff chemical officer is a member of the unit special staff, which includes officers of the various arms and services who may be assigned to a headquarters for special tactical, technical, supply, or administrative purposes. As a member of the special staff, the chemical officer in ground, air, and service units serves as technical expert to the commander and staff on the use of chemicals, as well as on proper defenses against them. These duties are comparable to the defensive duties of unit gas officers in lower echelons.

b. Authority. As a staff officer, the chemical officer makes recommendations to the commander and the staff for the employment of chemical materiel, chemical troops, and for the need for support by additional chemical troops. He has no authority as a staff officer to direct the training or operations of chemical or other troops serving the headquarters unless he is specifically delegated such a command function by the commander. When dealing with higher, lower, or adjacent headquarters, the chemical staff officer goes through his own commander or the appropriate staff officer of his own headquarters. He may, however, communicate directly with the chemical staff officer of higher, lower, or adjacent headquarters when handling technical matters which

do not involve questions of policy or do not apply to branches other than the Chemical Corps.

129. DUTIES. a. References. The chemical staff officer's duties and responsibilities are prescribed in FM 101–5. FM 3–5 supplies basic information on the principles of employment, munition requirements, and logistics of all ground chemical munitions. FM 3–6 provides similar information for air chemical munitions. See FM 21–6 for latest references.

b. Summary of duties. The following duties apply generally to chemical officers in ground, air, or service units, and to post chemical officers. Emphasis here is placed on defensive duties. For a more complete explanation of offensive duties, see FM 3–5 and FM 3–6. The chemical officer:

(1) Acts as adviser to the commander and staff on all chemical matters, including the use of chemicals by the various arms.

(2) Prepares an SOP for chemical defense for the unit.

(3) Makes recommendations for the assignment or attachment and the tactical employment of chemical troops, including their allotment to subordinate units.

(4) If so directed by the commander, supervises operations of chemical troops not allocated to subordinate units.

(5) Under the commanding officer and G–3, conducts schools for unit gas officers and noncommissioned officers, and supervises chemical warfare training of all units in the command, for-

wards names of school graduates to unit commanders, and collaborates with division surgeon on instruction in first aid for gas casualties.

(6) Checks constantly on gas discipline (including a check on the appointment of unit gas officers and alternates).

(7) Inspects protective equipment and supplies as frequently as required by tactical situation or as commanding officer may direct. (In zone of interior, inspections should be at least every 6 months; rigid inspection is made immediately prior to embarkation for a theater of operations or movement into a combat zone.)

(8) Advises unit gas officers.

(9) During preparations for combat, supervises collective protective measures within limits prescribed by commander. (This covers all routine individual and collective protective measures independent of the tactical situation.)

(10) In combat, advises on tactical protective measures.

(11) Keeps gas situation maps posted, using maps of the same scale as those used by G–2 and G–3 sections so that gas situation overlays (showing both friendly and enemy gassed areas) may be issued with periodic staff reports.

(12) Gives technical advice on decontamination. (In important large scale decontamination situations, the chemical officer may be placed in direct charge. If extremely urgent and large scale operations are involved, he may request army decontamination troops.)

(13) Under the commander and G–2, gathers information on enemy chemical activities and collects captured enemy chemical warfare materiel (through unit gas officers and directly).

(14) Transmits technical chemical intelligence and information through technical channels; that is, direct to chemical officer of next higher, lower, or adjacent echelon. Tactical intelligence is disseminated through usual G–2 channels.

(15) Recommends issuance of necessary instructions based on chemical intelligence.

(16) Under commander and G–4, supervises and controls supply of all authorized chemical supplies to all troops of the command. Keeps abreast of status of supplies.

(17) Supervises storage and handling of chemical supplies under control of the commanding officer and G–4.

(18) Supervises repair and rehabilitation of salvaged chemical warfare materiel.

(19) Supervises filling of chemical munitions prescribed for filling in the theater of operations.

(20) When so directed by the commander, supervises training in the use of flame throwers, their maintenance, and the mixing and issue of flame thrower fuel.

c. **Modifications.** Although the prescribed duties apply to all chemical officers, necessary modifications occur, depending on the unit and its mission. Furthermore, on posts where consolidated station property accounting exists, post chemical officers have no supply duties other than advisory; thus their major duties are training and inspection, as

listed in b above. At class I, II, and III installations where consolidated station property accounting is not in effect, the post chemical officer has the following duties (at the discretion of the commanding general of the service command or of the administrative service):

(1) Requisitions, receives, stores, and issues chemical warfare equipment.

(2) Requisitions and issues chemical warfare munitions.

(3) Advises the post ordnance officer on chemical warfare ammunition storage when ordnance magazine facilities are available.

(4) Disposes of materiel returns and excesses according to latest supply instructions.

(5) Is responsible for maintenance of proper stock levels.

(6) Conducts training in chemical warfare defense for service troops and other troops and units as requested.

(7) Advises the post commander on all chemical warfare matters; conducts necessary inspection to insure that policies and instructions of higher authority are applied and carried out, particularly as to training, supply, maintenance, and salvage.

Section II. SCHOOL OF THE CHEMICAL OFFICER

130. INTRODUCTION. The chemical officer should be thoroughly trained to be able to carry out any chemical warfare functions the commander may give him. To fulfill his capacity as adviser to the commander in any situation in which chemical agents are used, he requires a degree of technical information beyond the scope of this manual.

This section provides an outline of the basic information needed by the chemical officer, together with references to War Department publications containing that information. FM 21–6 is to be consulted in every case for the latest publications. Chemical warfare materiel and tactics are in a constant state of development.

131. CHEMICAL AGENTS. The chemical officer must know United States chemical agents in detail, and enemy chemical agents so far as he can discover the information. He must know their characteristics, uses, effects, protection required, and the munitions from which they are released.

a. **Characteristics.** See figure 35; reference charts in FM 3–5 and 3–6; and TM 3–215 and 3–300.

b. **Tactical uses.** See FM 3–5, 3–6, and 3–50.

c. **Physiological effects and first aid.** See figure 35; reference charts in FM 3–5 and 3–6; and TM 3–215 and 8–285.

d. **Protection required.** See figure 35, and TM 3–290.

e. **Methods of release.** Chemical officers should be thoroughly familiar with the characteristics of all weapons (capable of using chemical agents) in the command. See FM 3–5 and 3–6; TM 1–282, 3–300, 3–320, and 9–1980. For artillery weapons, mortars, flame throwers, smoke generators, land mines, grenades, and portable cylinders, see TM 3–300 and appropriate references listed in FM 21–6.

132. METEOROLOGY AND BEHAVIOR OF CHEMICAL AGENTS. The chemical officer must have a basic understanding of the behavior of chemical

agents under various meteorological conditions and on various types of terrain. TM 3–240 contains basic information. Specific applications for tactical use are made in FM 3–5, 3–6, 3–50, and TM 1–282. Weather observations and microweather forecasts for particular localities are furnished by Army Air Forces and by Chemical Corps observers. The chemical officer must secure and consider these prior to any operation.

133. DEFENSE MEASURES AND EQUIPMENT. a. Repair and rehabilitation. Under the commander, the chemical officer is responsible for repair and rehabilitation of chemical warfare equipment in his unit. FM 21–6 lists maintenance and operational manuals for all chemical warfare equipment, and copies of the manuals accompany the equipment into the field.

b. Individual measures and equipment. Individual equipment carried by the soldier is discussed in TM 3–290. Gas masks, including special canisters, the dog mask and headwound mask. and mask fitting procedures, are covered in TM 3–205. The horse gas mask is covered in TM 3–230.

c. Individual decontamination. TM 3–220 and 8–285 prescribe procedures for decontamination performed by the individual, whether on his own person or on various items of equipment. Hand decontaminating apparatus are discussed in TM 3–220.

d. First aid. Under the commander, the division surgeon, aided and advised by the chemical officer, is responsible for setting up first-aid procedures and facilities for those injured by chemi-

cal agents. Individual procedures are prescribed in paragraphs 15 through 19. FM 21–11 contains first-aid procedures. TM 8–285 discusses *treatment* (as distinguished from first aid) for specific agents, and figure 35 summarizes specific first-aid methods.

e. Alarms. The sounding of the alarm upon a gas attack is prescribed in paragraphs 45 through 47. Mechanical alarms, their use and maintenance, are described in TM 3–290.

f. Collective protectors. TM 3–350 contains the general principles of gasproof shelters, as well as specific directions for gasproofing them. Use and maintenance of collective protectors are also discussed in TM 3–350. Inspection procedure for the gasproof curtain, M1, is outlined in TB 3–350–1S1.

g. Large scale decontamination. The chemical officer may be directed to supervise decontamination conducted on a large scale. Procedures are covered in TM 3–220. The use and maintenance of the 400-gallon power-driven apparatus are described in TM 3–221, 3–222, 3–223, and 3–228. The motorized dry agent decontaminating apparatus (bleach spreader) is described in TB CW 14. Large scale clothing decontamination is performed by Quartermaster laundries or chemical processing companies.

h. Reimpregnation. Reimpregnation is normally performed by chemical processing units but may be done in forward areas by Quartermaster mobile laundries converted to processing units. Tests on impregnated clothing may be performed in the field. (See TM 3–290.)

i. Incendiary defenses. Normally, procedures to be followed during incendiary attacks are included in the unit SOP. A general procedure is set forth in paragraphs 62 through 66. The various types of incendiary bombs, including clusters, are described in TM 9–1980. Tactical use of incendiaries is prescribed in FM 3–5 and FM 3–6.

j. Protection of food and water. Final disposition of food and water suspected of being contaminated is the decision of the surgeon. Procedures to be followed in specific cases are prescribed in TM 8–285.

134. TACTICAL CONSIDERATIONS. a. SOP and planning. FM 101–5 contains outlines for typical combat orders and SOP. Paragraphs 67 through 86 set forth general considerations, together with a check list, for guidance in preparing the SOP. Tactical plans are formulated for the specific situation and depend on friendly as well as enemy capabilities.

b. Reconnaissance and intelligence. FM 21–6 should be consulted for complete lists of War Department publications on reconnaissance, intelligence, and counter-intelligence. General principles are discussed in paragraphs 67 through 86. (See also FM 30–5.)

c. Mapping and situation map. FM 30–20 discusses intelligence maps. FM 21–6 should be consulted for publications on specific phases of mapping, such as use of the template and grids.

135. SUPPLY. The chemical officer keeps abreast of the status of chemical warfare supply in order that he can make recommendations for the em-

ployment of chemicals in offensive and defensive operations. This includes keeping accurate records of the amount of munitions on hand in unit dumps and those munitions available by allocation from higher headquarters. Other factors affecting supply are location of dumps, distance of haul, condition of roads, availability of transportation, time required for drawing supplies, and time available to complete the preparations. All requisitions for chemical warfare supplies come through the office of the chemical officer. For the flow of supplies, see figure 34. Details of chemical warfare supply methods are found in FM 3–15. The Table of Organization and Equipment of the unit should be consulted, together with WD Catalogs QM 4, CW 3, and CW 4–1.

136. TRAINING DOCTRINE AND METHODS. FM 21–5 contains the basic principles of army training. Chemical officers should be thoroughly familiar with the principles set forth therein. TM 21–250 contains specific applications of the principles prescribed in FM 21–5. In addition, TM 3–305 is to be consulted for specific chemical warfare training exercises. Training films, film strips, film bulletins, and slides are listed in FM 21–7. War Department graphic training aids are listed in FM 21–8. Chemical Corps graphic training aids are listed in Graphic Training Aids Catalog. The latter includes charts on flame throwers, the 4.2-inch chemical mortar, 4.2-inch chemical shell, and hand decontaminating apparatus. Allowances of expendable supplies for training are listed in WD Catalog CW 4–1.

APPENDIX I APPROXIMATE DURATION OF HAZARD FROM MUSTARD GAS CONTAMINATION

Expressed in approximate time after contamination that task may be performed safely with protection as indicated. Density of contamination: 30 to 150 tons of mustard gas per square mile (200 to 1,000 pounds per 100 by 100 yard square) contaminated by U. S. standard munitions with bursters.

NOTE: These figures are based on field tests with Class II protection. With Class I protection, tasks may be accomplished at earlier times. For classes of protection, see paragraph 95.

TASK	TERRAIN	With impregnated clothing Class I and Class II protection		Without impregnated clothing ❶❷	
		Temperate (60°-80°F.)	Hot (above 80°F.)	Temperate (60°-80°F.)	Hot (above 80°F.)
TRAVERSAL ❸ Walking across the area (2 hours)	Bare soil, sand, or short grass	0	0	(wearing masks) 36 hours	36 hours
	Low vegetation	4 hours	2 hours	(wearing masks) 36 hours	36 hours
	High vegetation, including jungle and heavy woods	12 hours	6 hours	(wearing masks) 4 days	2 days
ADVANCE UNDER FIRE Contact with ground 1 hour (2 hours total time)	Bare soil or low vegetation	24 hours	8 hours	(not wearing masks) 3 days	2 days
	High vegetation, including jungle and heavy woods	2 days	24 hours	(not wearing masks) 6 days	4 days
OCCUPATION Without hitting ground (24 hours)	Bare soil or low vegetation	1 hour	1 hour	(not wearing masks) 4 days	3 days
	High vegetation, including jungle and heavy woods	1 hour	1 hour	(not wearing masks) 4 days	3 days
OCCUPATION Involving advance under fire (24 hours)	Bare soil or low vegetation	24 hours	8 hours	(not wearing masks) 4 days	3 days
	High vegetation, including jungle and heavy woods	2 days	24 hours	(not wearing masks) 6 days	4 days

❶ For men without protective clothing walking in a contaminated area for 2 hours, the limiting factor is the vapor. If the traverse requires only a few minutes, it can be accomplished at earlier times.

❷ The approximate times at which troops could occupy areas without having to wear masks apply to men with or without protective clothing. The vapor hazard is the limiting factor. These estimates are especially important from the field standpoint.

❸ For men with impregnated clothing, when traversal is made in daylight and areas of heavy contamination can be avoided or decontaminated, the times can be reduced to about one-half of those given in the table.

Figure 30. Approximate duration of hazard from mustard gas contamination.

APPENDIX II
MILITARY ANIMALS IN CHEMICAL WARFARE

1. INTRODUCTION. Military animals include horses, mules, dogs, and pigeons. Animals are protected against chemical agents by:

a. Protective devices: gas masks, eyeshields, and protective covers.

b. Training to accustom animals to wearing protective equipment.

c. Defense measures taken by the soldier to reduce risk of injury to the animal while performing normal duties. For example, animals should be prevented from drinking from water holes, trenches, or shell craters and from taking food in areas which have recently been contaminated, until the water and food are known to be suitable for consumption.

2. SUSCEPTIBILITY TO WAR GASES. a. Horses and mules. Since horses and mules are similar in anatomy and in sensitivity to chemical agents, both animals are indicated whenever horses are referred to below.

(1) *Parts affected.* Anatomical regions affected by chemical agents include:

(a) Respiratory system. Air passages and lungs are sensitive to casualty war gases.

(b) Eyes. Eyes of horses are not seriously affected by war gas *vapors* in ordinary field concentrations. *Liquid* blister gas in the eyes causes serious injury, often blindness. If eyes are affected by war gases, further injury to the eyes by rub-

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bing may be prevented by tying the halter shank as short as possible.

(c) Digestive system. If the animal consumes foliage or water contaminated with blister gas or licks contaminated parts of his body, casualties may be produced.

(d) Skin. Liquid blister gas injures any part of the skin, but the greatest action is on the lower leg, where injuries hinder movement.

(2) *Individual protection.* This is furnished by the animal's gas mask, eyeshield, protective leggings, body cover, or other protective devices, and by restraint on the animal's movements. Lungs and air passages are protected by adjusting the mask. The horse gas mask M4 or M5 is similar in functioning to masks used by man. A muzzlepiece of molded rubber fits over the nose and mouth, providing an airtight seal. (See figure 31.) The body is protected by using a body cover or by giving the animal shelter in anticipation of a spray attack. Shields may be supplied for the eyes, and protective leggings supplied to cover sensitive parts of the hoof and lower leg. (See figure 32.) The wall, sole, and horny frog of the hoof are not sensitive to blister gases. Of the lower leg, the coronet, the bulb of the heel, the fetlock, and particularly the hollow of the heel are sensitive and, when affected, incapacitate the animal.

b. Dogs. (1) *Parts affected. (a) Respiratory system.* Air passages and lungs are sensitive to casualty war gases, but dogs are less susceptible to injury from these gases than men.

(*b*) *Eyes.* Except when exposed for more than 15 minutes to ordinary field concentrations, dogs' eyes are not seriously affected by war gas *vapors. Liquid* blister gas causes serious injury and possible blindness.

(*c*) *Digestive system.* Consumption of food and water contaminated with blister gas may cause casualties, as does licking contaminated skin areas.

Figure 31. Horse gas mask M5, with muzzlepiece adjusted.

(d) *Skin.* The hair gives dogs temporary protection from the action of liquid war gases. The greatest danger is from injury resulting from action of blister gas on feet and legs.

(2) *Individual protection.* This is furnished by the dog gas mask (figure 33), which fits over the muzzle and eyes. A section of transparent plastic serves as an eyepiece. Special defense measures are to be followed for dogs:

(a) They should be trained not to remove their masks. Training periods should be increased from 5 minutes to 30 minutes, when the dog is accustomed to the mask; review training periods should be given at infrequent intervals.

(b) They should be carried through areas contaminated with liquid blister gas to prevent injury to the feet, legs, and underbody.

c. Pigeons. (1) *Effects of war gases.* Pigeons are susceptible to respiratory injury, but they are nearly always high enough when flying to escape effective concentrations. Danger of blister gas action on the skin is small, since feathers provide natural protection.

(2) *Protection.* Individual protection is impractical. Group protection for 15 birds or less is provided by protective pigeon bag M2. When group protection is not available, pigeons are released at once in the event of a gas attack.

3. FIRST-AID PROCEDURES. a. General. The effects of most chemical agents on animals are similar to the effects produced on man; however, in some cases, they are less severe. Information on human casualties from chemical agents is generally appli-

cable to animals. Only facts important in the handling of gassed military animals, therefore, are stressed below.

b. Specific procedures. The soldier administers first aid to the extent permitted by field conditions. He should seek the aid and advice of veterinary or unit gas personnel as soon as the situation permits. Treatment of animal casualties from chemical agents is given in TM 8–285.

(1) *Blister gases.* For blister gas in the eyes, apply BAL (liquid or ointment). If possible, massage the eye gently to distribute BAL over eye surface. Blot skin with absorbent cloth or paper, giving particular attention to lower legs if animal has crossed contaminated ground. Bleach paste can be scrubbed into hair coat, but it must be washed off within 5 minutes. Protective ointment can be used for decontamination, but it must be washed off with soap and water within a few hours. Use of solvents (such as gasoline or kerosene) for decontamination is not recommended. The solvents are irritating to the skin and tend to spread the area of contamination rather than to wash off the war gas. Do not let the animal lick, bite, rub, or scratch contaminated skin.

(2) *Choking gases.* Remove from gassed area with minimum of physical effort on animal's part. Keep quiet and warm.

(3) *Blood and nerve poisons.* Move to fresh air immediately and remove any liquid contamination with soap and water, or flush with water. If animal is conscious and breathing, no further treatment is necessary, but animal should be kept quiet

until recovery is apparent. If animal enters coma, crush amyl-nitrite ampoule and hold to nose, or, if mask is adjusted, crush ampoule and quickly place inside the gas mask, or insert ampoule through the outlet valve.

(4) *Vomiting and tear gases.* In field concentrations, these war gases have little effect upon animals, especially horses. Severe irritation may result when liquid tear gas gets into the eyes. The treatment is immediate irrigation with water or sodium bicarbonate solution.

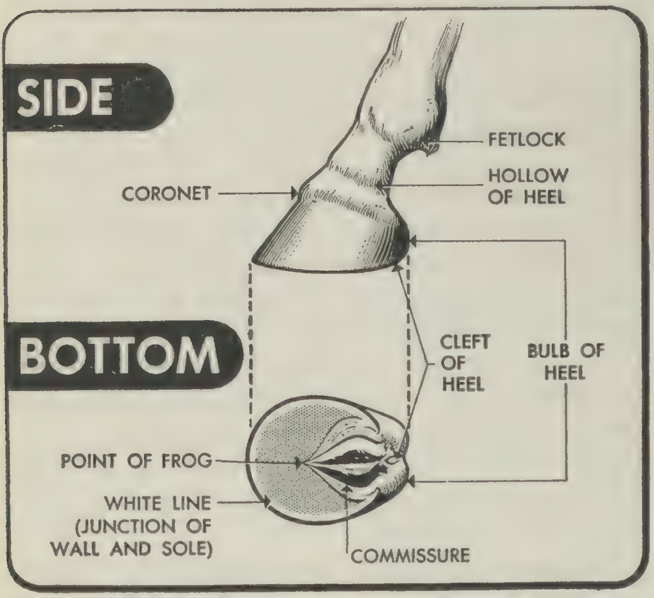


Figure 32. Vital parts of horse's hoof.

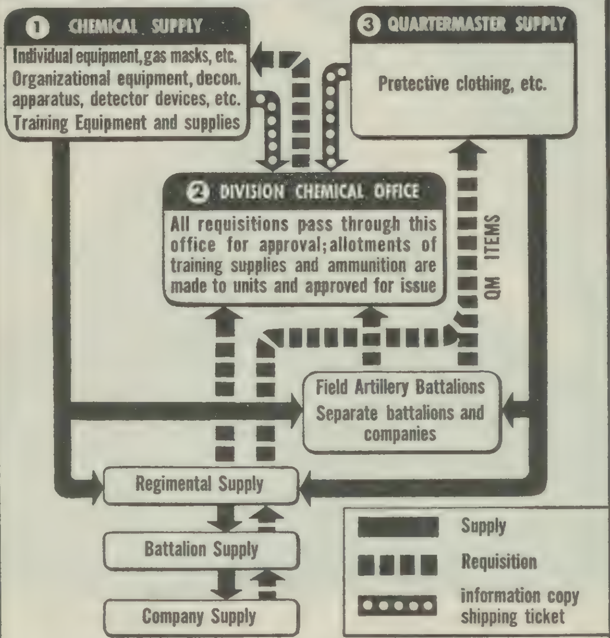
(5) *Screening smokes.* If burning particles of white phosphorus are on skin, apply wet copper

Figure 33. Dog gas mask M6–12–8.

sulfate pads. If no copper sulfate pads are available, smother the burn immediately with water or mud. Keep skin wet until particles can be removed. Pick out particles with knife, bayonet, or other object. Do not use copper sulfate pads for dressings. If eye burns follow exposure to liquid smoke particles, irrigate eyes with water or sodium bicarbonate solution.

(6) *Incendiaries.* First aid for burns from incendiary agents is that used for any heat burn.

APPENDIX III FLOW OF SUPPLIES



❶ When on a post, chemical supply to units will come from the post chemical office. When in the field, supply may come from chemical depot companies or from division supply points. Information regarding the type and location of supply installations is given in the G-4 administrative order.

❷ In combat, chemical ammunition may be obtained by the using unit directly from ammunition supply point on a memorandum requisition through the division ammunition officer. Similarly, other items of chemical supply may be drawn by the using unit directly from the chemical depot on a memorandum requisition approved through the division chemical supply officer.

❸ Medical supply is handled in the same manner as quartermaster supply.

Figure 34. Flow of supplies.

APPENDIX IV READY REFERENCE CHART TO CHEMICAL AGENTS

Known chemical agents of world powers that the soldier may encounter

NAME	SYMBOL	HOW TO DETECT: ODOR (Commonly Accepted)	HOW TO DETECT: COLOR AND STATE IN FIELD	HOW TO DETECT: DETECTION DEVICES	PERSISTENCY (Highly Variable)	EFFECT ON BODY	PROTECTION	FIRST AID: INDIVIDUAL SOLDIER	FIRST AID: GAS CASUALTY FIRST AID KIT	METHODS OF DISPERSION
CASUALTY GASES										
BLISTER GASES										
Mustard gas	H	Garlic or horseradish	Dark; oily liquid	Paper, paint, crayon, M9 kit	1 to 20 days	Injures eyes and lungs; blisters skin	Protective clothing and gas mask (Eyeshields and protective cover against spray)	For blister gas in eye, apply BAL, massage 1 minute, flush for ½ to 2 minutes with water. For liquid on skin, pinch-blot liquid off skin and apply protective ointment. Liquid must be removed within 3 minutes	For any blister gas in eyes, use BAL eye solution (item 5) or BAL ointment (item 8) as shown at left. For liquid blister gas on skin, use protective ointment (item 9). For lewisite, use BAL ointment (item 8). BAL may be used after skin reddens	Land mine, spray, bomb, artillery, rocket, mortar
Nitrogen mustards	HN	Very slight, if any; fishy or soapy	Dark; liquid or soft solid	Paper, paint, crayon, M9 kit	1 hour to several weeks	Injures eyes and lungs; blisters skin				
Lewisite	L	Irritating, sometimes like geraniums	Dark; oily liquid; evaporates slowly	Paper, paint, crayon, M9 kit	1 to 7 days	Injures eyes and lungs; blisters skin				
Phenyldichlorarsine Ethyldichlorarsine Methyldichlorarsine	PD ED MD	Generally irritating	Colorless liquids; evaporate slowly	Paper, paint, crayon; M9 kit detects ED and MD only	PD: 1 to 40 days; others: 1 to 12 hours	Injures eyes and lungs; blisters skin				
CHOKING GASES										
Phosgene	CG	New-mown hay or fresh corn	Colorless gas	M9 detector kit	1 to 10 minutes	Causes choking and coughing; injures lungs	Gas mask	Keep quiet and warm. Give warm drinks.	None	Bomb, artillery, mortar, rocket, cylinder
Chlorpicrin	PS	Flypaper	Colorless liquid; evaporates slowly	None	1 hour to 1 week	Causes tears, coughing, and vomiting	Gas mask	Keep quiet and warm; face into wind with eyes open—don't rub them.	Eye and nose drops (item 4)	Bomb, artillery, mortar, rocket, cylinder, spray
BLOOD AND NERVE POISONS										
Cyanogen chloride	CK	Irritating	Colorless gas	M9 detector kit	1 to 10 minutes	Paralyzes; injures lungs and causes tears	Gas mask	Keep warm. Drink warm liquids	Amyl nitrite (item 7)	Bomb, artillery, mortar, rocket, grenade
Hydrocyanic acid	AC	Bitter almonds	Colorless gas	None	1 to 10 minutes	Paralyzes; dizziness, [redacted]	Gas mask	Mask. Artificial respiration, if necessary. Get to fresh air. Wash liquid from skin	Amyl nitrite (item 7)	
Arsine	SA	Odorless, or like garlic	Colorless gas	None	1 to 10 minutes	Affects kidneys and liver	Gas mask	Delayed action. Keep quiet and get medical aid	None	

	VOMITING GASES										
HARASSING GASES	Adamsite	DM	Usually odorless	Yellow smoke	None	1 to 10 minutes	Cause vomiting, sneezing, headache, mental depression	Gas mask	If unable to carry on, loosen clothes, wash skin, rinse nose and throat with water	Chloroform (item 1)	Bomb, artillery, mortar, grenade, candle
	Diphenylchlorarsine	DA	Usually odorless	White smoke	None	1 to 10 minutes		Gas mask		Chloroform (item 1)	
	Diphenylcyanarsine	DC	Mixture of garlic and bitter almonds	White smoke	None	1 to 10 minutes		Gas mask		Chloroform (item 1)	
	TEAR GASES										
	Chloracetophenone	CN	Apple blossoms	Colorless gas or fine solid particles	None	1 to 10 minutes	Causes tears, irritates skin	Gas mask	Mask. When area is clear, remove mask and face into wind; don't rub eyes	Eye and nose drops (item 4)	Artillery, mortar, grenade, candle
	Brombenzylcyanide	BBC	Sour fruit	Liquid, evaporating to form gas	None	Several days	Causes tears, irritates skin	Gas mask		Eye and nose drops (item 4)	Artillery, grenade, candle
	Tear gas solution	CNS	Sweetish	Liquid, evaporating to form gas	None	1 to 50 hours	Causes tears, irritates skin	Gas mask; protective cover against spray	Mask. When area is clear, remove mask and face into wind; don't rub eyes; wash skin touched by liquid	Eye and nose drops (item 4)	Bomb, spray, mortar, artillery
	SCREENING SMOKES										
SCREENING SMOKES	White phosporus	WP	Mildly irritating	White smoke and burning particles	None	None	Solid particles burn skin	Avoid burning particles	Use copper sulfate pads	Copper sulfate solution (item 3)	Land mine, bomb, artillery, mortar, grenade, rocket
	Sulfur trioxide-Chlorsulfonic acid	FS	Acrid	Dense white smoke	None	None	Liquid burns skin	Gas mask in high concentrations	Wash eyes with water at once. Wash liquid from skin. Treat as a burn	Eye and nose drops (item 4)	Land mine, bomb, spray, mortar, artillery, grenade, cylinder
	Titanium tetrachloride	FM	Acrid	Dense white smoke	None	None	Liquid burns skin	Gas mask in high concentrations or enemy smoke	Blot off liquid, then wash. Treat as a burn	None	
	HC mixture	HC	Sharp, acrid	Gray smoke	None	None	Not dangerous in normal concentration		None	None	Artillery, mortar, grenade, smokepot
	Fog oil	SGF	Like oil	White smoke	None	None	None	None	None	None	Smoke generator
	INCENDIARIES										
INCENDIARIES	Magnesium	None	Smoky	White smoke, white flame	None	None	Causes burns	Extinguish with sand or earth. Fight fire with available means, depending on unit	Flood with water, remove particles, treat as a burn	None	Bomb, grenade
	Thermit	TH	Smoky	Orange glow	None	None	Causes burns		Flood with water, remove particles, treat as a burn	None	Bomb, grenade
	Incendiary oil	IM NP PT	Oil	Black smoke, red flame	None	None	Causes burns		Treat as a burn	None	Bomb, artillery, rocket, grenade, flame thrower

Figure 35. Ready reference chart to chemical agents.

APPENDIX V SERVICE

NAME	DUTIES	ASSIGNMENT	LOCATION	ORGANIZATION
TABLE A	**CHEMICAL SERVICE UNITS WITH COMBAT TROOPS**			
CHEMICAL DEPOT COMPANY T/O & E 3-67	Maintains army chemical depot. Supplies CWS items to all troops assigned or attached to a field army	Normally one company per army up to 150,000 men	Normally in center of army service area	Headquarters and three service platoons
CHEMICAL MAINTENANCE COMPANY T/O 3-47	Maintenance and repair of army protective equipment. Servicing, maintenance, and repair of CWS weapons employed by army troops	Normally one per army	Center of service area, near depot company	Headquarters and two repair platoons
CHEMICAL DECONTAMINATION COMPANY T/O & E 3-217	Large-scale decontamination of materiel and critical areas important to army (but seldom in forward areas)	Normally one company per 100,000 strength in task force	Center of service area, near chemical depot company	Headquarters and four service platoons
CHEMICAL WARFARE GENERAL SERVICE COMPANY T/O & E 3-137S	Procures, stores, and issues chemical materiel and performs 3rd and 4th echelon maintenance. Also trained in the decontamination of areas and materiel and for smoke screen operations involving the use of smoke pots	One to theater of operations	Normally in communications zone	Headquarters and supply section, laboratory section, and maintenance sections
TABLE B	**CHEMICAL SERVICE UNITS WITH ARMY AIR FORCES**			
CHEMICAL DEPOT COMPANY, AVIATION T/O 3-418	Operates chemical ammunition depot at air force depot level; stores bulk chemicals, incendiaries, and chemical bombs	One company per combat wing capable of performing chemical missions	In air force depot area	Administrative section, chemical section, incendiary section, and security and maintenance section
CHEMICAL COMPANY, AIR OPERATIONS T/O & E 3-457	Handles air chemical munitions (spray tanks and bombs), delivers them to aircraft, and helps armament personnel mount and arm them	One per combat group performing chemical missions	At air bases as required, otherwise as assigned by air force commander at chemical ammunition depot	Headquarters, distributing point section, and four platoons

Figure 36. Service troop organizations.

TROOP ORGANIZATIONS

TABLE C CHEMICAL SERVICE TROOPS

NAME	DUTIES	ASSIGNMENT	LOCATION	ORGANIZATION
CHEMICAL PROCESSING COMPANY T/O & E 3-77	Operates two impregnating plans (one per platoon). Clean clothing to be impregnated is furnished by Quartermaster Corps	Normally to theater of operations	Normally in communications zone	Headquarters and two platoons
CHEMICAL BASE PROCESSING CO. T/O 3-87	Large-scale impregnation of clothing	Normally on basis of one company per 300,000 men	At base chemical depot or base general depot	Headquarters and three platoons
CHEMICAL LABORATORY COMPANY T/O & E 3-97	Conducts tests and research in field. Examines enemy chemical agents, protective equipment, and weapons; surveillance of friendly protective equipment and chemical munitions; handles miscellaneous technical problems regarding chemical agents	Normally one per theater under theater chemical officer	Center of theater it serves	Headquarters and five technical sections (organic, analytical, chemical engineering, intelligence, toxicology)
CHEMICAL SERVICE ORGANIZATION T/O & E 3-500	Provides cellular units of various sizes to be organized into composite units	Various units serve from 5,000 to 100,000 men	In communications and combat zone	Administrative section decontamination team, maintenance team, depot team, processing team, and laboratory team
CHEMICAL BASE DEPOT COMPANY T/O & E 3-117	Handles chemical munitions and supplies	Normally one per 100,000 men	At base chemical depot or chemical section of base general depot	Depot headquarters, company headquarters, and sections for stock control, ammunition, toxic gas, and general supply
CHEMICAL SMOKE GENERATOR COMPANY T/O & E 3-267	Produces large smoke blankets for protection of vital defense or industrial organizations, or important fixed installations nearer the front. Produces smoke for tactical missions	To theater of operations as needed; several may be grouped in battalion. To combat units for tactical missions	Variable; as needed	Company headquarters, headquarters platoon (for technical direction), and operations platoon

TABLE D MEDICAL GAS TREATMENT BATTALION

T/O 8-125 This is a medical organization designed to provide immediate treatment for gas casualties in the field. A battalion is composed of headquarters and three clearing companies, each with a capacity of 400 patients. Bath and treatment are provided in each of the two clearing platoons per clearing company. Personnel are specially trained to treat gas casualties.

Figure 36—Continued.

APPENDIX VI
GAS MASK INSPECTION AND DRILLS

Section I. PRINCIPLES

1. PURPOSE. In an emergency, men must be able to don their gas masks smoothly and with minimum interruption to their regular duties.

2. CAREFUL ADJUSTMENT. Preliminary training may be given by the numbers. Although uniformity of movement is desirable, gas mask drills should not be conducted as precision movements. Careful adjustment is far more important.

3. SPEED. Speed is secondary to careful adjustment, and it should be developed after trainees have mastered the by-the-numbers drill. Exercises may be conducted without numbers to develop speed. Men are taught to mask rapidly and accurately under all conditions—standing, prone, kneeling, in darkness, in standard types of uniforms, and with and without equipment.

Note. For consistency, gas mask drills illustrated in this manual show the helmet chin strap fastened. Whether the strap is fastened under the chin is a command decision. If the chin strap is not fastened, the helmet may be placed between the knees or over the canteen carrier (whichever is more convenient) while masking, instead of as shown in the following pictures.

Section II. INSPECTIONS AND FITTING

4. GENERAL. In general, gas mask inspections and adjustments are the same no matter what type of mask is being used. Procedures are given below:

a. Formal inspection. (1) When field equipment is not displayed, the command is PREPARE FOR MASK INSPECTION. The unit opens ranks as prescribed in drill regulations. Each soldier masks and checks his mask for the proper fit as the inspecting officer approaches. The officer examines fit and adjustment of the mask. The facepiece is then removed and handed to the officer, who examines it for cleanliness and condition. If desired, he orders the canister removed from the carrier (except with combat and snout type masks) and examines it. The mask is replaced in the carrier and its position is checked by the officer.

(2) When personal field equipment is displayed, gas masks are examined after displays have been inspected. ***(Caution.*** Masks should not be displayed on the ground in bright sunlight.) The unit commander cautions: GAS MASKS WILL BE INSPECTED. Subordinate commanders order: 1. SLING. 2. MASKS. This command is executed and inspection then follows procedures outlined above for inspection when field equipment is not displayed.

(3) Inspection of mounted organizations includes the inspection of horse gas masks.

b. Informal inspection. Masks must be inspected when issued, and periodically thereafter to detect deterioration. Such inspections must be supervised by the unit commander, or by someone designated by him. The procedure varies slightly depending on the type of mask used, but, in general, it is as follows:

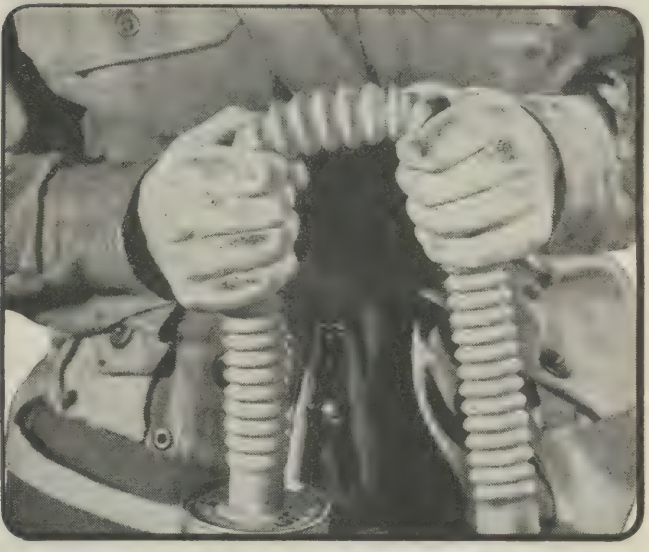
① *Figure 37.*

(1) Remove facepiece and canister from carrier, then examine carrier. There must be no tears or rips. Straps (if any) used to hold canister in place must not be broken. Protective and first-aid equipment stored in the carrier must be in place.

② *Figure 37—Continued.*

(2) Examine canister. Look for holes and large dents in canister body. If there is rust or corrosion, it may indicate the canister has been wet. Moisture cakes and damages chemicals, lowering

the chemical efficiency of the canister and causing the wearer of the mask difficulty in breathing.



③ *Figure 37—Continued.*

(3) Examine hose (if any). Holes, splits, and tears may be patched temporarily, but hose should be replaced as soon as possible. Replacement is also necessary if hose has become kinked or stretched through improper storage, or if the rubber is tacky. Make certain that hose connections to canister and facepiece are tight. This is done by twisting vigorously and pulling the connections.

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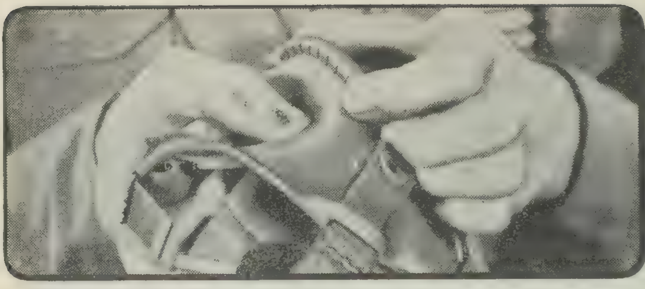


④ *Figure 37—Continued.*

(4) Examine facepiece carefully, including head harness, eyepieces, and outlet valve. Head harnesses may lose their elasticity through improper storage, or rubber threads of the elastic straps may break if head harness is worn too tight. Eyepieces may be badly scratched, or cracks and splits may have developed near eyepieces. Outlet valves may stick after disinfection or in cold weather; they can usually be cleaned by wiping with a dry cloth.

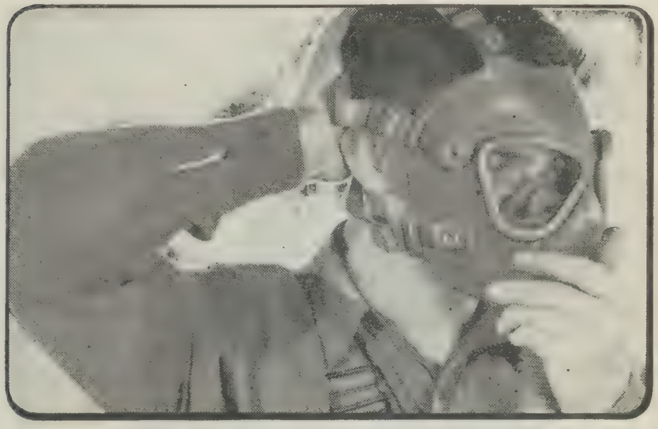
⑤ *Figure 37—Continued.*

(5) Put the mask on the face and check it by shutting off the hose at the canister connection;

the facepiece should collapse when the soldier inhales, and should remain collapsed for at least 10 seconds.

(6) Any defect discovered during inspection is reported to instructor in charge. Minor defects can be repaired within the company.

c. Adjusting fit of mask. This procedure is conducted informally under direction of a unit officer, gas officer, or gas noncommissioned officer. (But the company commander is personally responsible for the fit of masks issued to personnel in his unit). Steps for adjusting size of the facepiece are as follows:

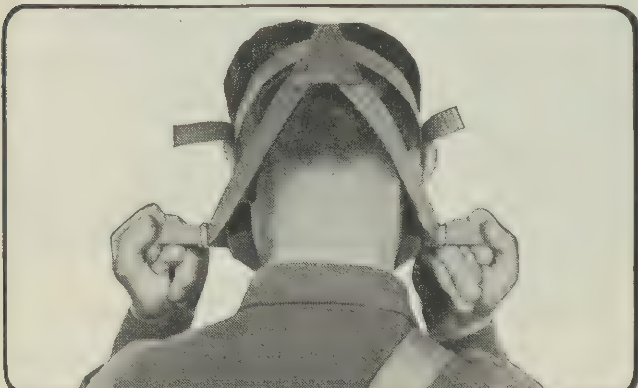


⑥ *Figure 37—Continued.*

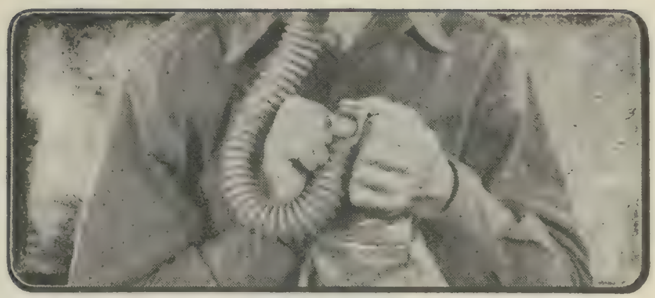
(1) Loosen all straps and put facepiece on, holding it firmly against chin with one hand; with the other hand, center head harness pad fairly well down on the back of head.

⑦ *Figure 37—Continued.*

(2) Adjust middle pair of straps by tightening them evenly until buckles lie flat. (Ends of straps must be the same length; straps should clear ears and fit comfortably.)



⑧ *Figure 37—Continued.*



⑨ *Figure 37—Continued.*

(3) Adjust top straps to center the head pad. Adjust bottom straps to attain comfortable fit.

(4) Check mask by shutting off air while inhaling to see if facepiece collapses properly.

(5) Repeated adjustment of straps may be necessary if facepiece still does not fit. But be sure to pull up straps by pairs, not singly. Do not get them too tight: headaches and discomfort may result or—worse yet—a channel may develop at edge of facepiece, allowing gas to enter.

(6) If leakage still occurs, a faulty mask is indicated and the entire assembly should be inspected as outlined above

LIGHTWEIGHT SERVICE MASK

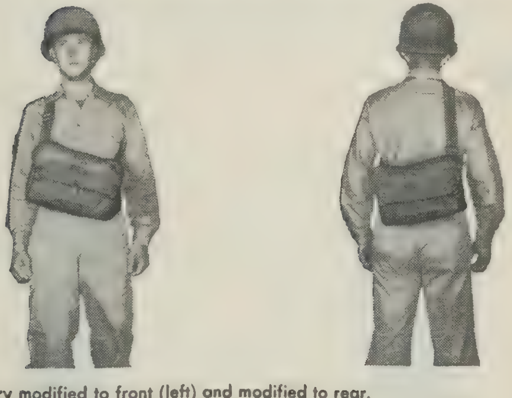
CARRYING POSITIONS

Gas alert (most satisfactory position when mask is adjusted).

Back carry, with and without pack. (Facepiece can be worn with mask at back carry only when pack is carried.)

Figure 38. Drill with lightweight service mask.

Side carry (cannot be used when face-piece is adjusted).



Side carry modified to front (left) and modified to rear.

Figure 38—Continued.

LIGHTWEIGHT SERVICE MASK

TO SLING AT GAS ALERT

"GAS ALERT . . . SLING, MASK"

A

B

A Hold carrier by shoulder strap in left hand, flap of carrier away from body.
B With both hands, swing strap over head.

"TWO"

D

E

D Shorten shoulder strap by hooking harness snap into "D" ring at carrier.
E Lengthen or shorten body strap as needed, then . . .

Figure 38—Continued.

C Pass left elbow through loop. Let mask drop to side.

NOTES:

1. If carrying full field equipment, sling pack first, then the mask.

2. To adjust shoulder strap, move shoulder strap slide so that carrier is about at waistline. Then position shoulder-strap harness snap so that when it is used the carrier is well up on chest.

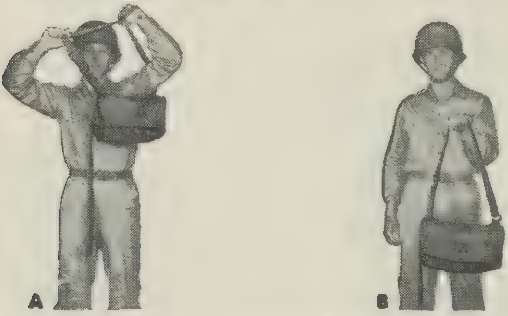
F Pass it around waist and fasten to small "D" ring at bottom of carrier.
G Final position.

Figure 38—Continued.

LIGHTWEIGHT SERVICE MASK

TO SLING AT SIDE CARRY

"SIDE CARRY... SLING, MASK"



A Hold carrier by shoulder strap in left hand, flap of carrier away from body.
B With both hands, swing strap over head.

"TWO"

D Lengthen or shorten body strap as needed. **E** Then pass it around waist and fasten to small "D" ring at bottom of carrier.

Figure 38—Continued.

C

C Pass left elbow through loop. Let mask drop to side.

F

F Final position. (If desired, slide carrier to front or back for modified side carry.)

Figure 38—Continued.

LIGHTWEIGHT SERVICE MASK

TO SLING AT BACK CARRY

"BACK CARRY . . . SLING, MASK"

A

B

A Hold carrier by shoulder strap in left hand, flap of carrier away from body.
B With both hands, swing strap over head.

"TWO"

D

E

D Shorten strap by hooking harness snap into "D" ring at carrier. **E** Slide carrier around under left arm into position on back.

Figure 38—Continued.

C

C Pass left elbow through loop. Let mask drop to side.

NOTES:

1. If carrying full field equipment, sling pack first, then mask. Carrier is up-ended and positioned high at left, resting against side of pack.

2. To adjust shoulder strap, move shoulder strap slide so that carrier is about at waistline. Then position shoulder strap harness snap so that when it is used the carrier is well up on chest.

F

G

F Pass body strap around equipment on back and fasten to sliding loop on shoulder strap. **G** Final position.

Figure 38—Continued.

LIGHTWEIGHT SERVICE MASK

TO CHANGE CARRY POSITION

"GAS ALERT... SLING, MASK"

NOTE:

Example at right is from back carry to gas alert. Any such drill may be directed by the instructor, command for the new position being given in the same manner as if the carrier were unslung.

A Unfasten body strap.

TO UNSLING MASK

"UNSLING... MASK"

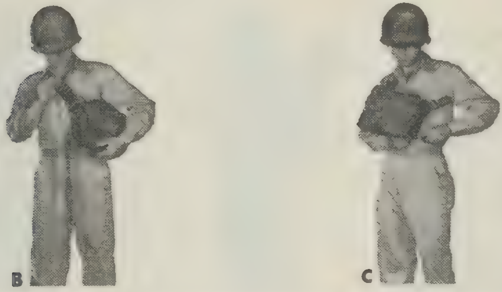
NOTE:

Example at right is from side carry. Similar procedure is followed from other carry positions.

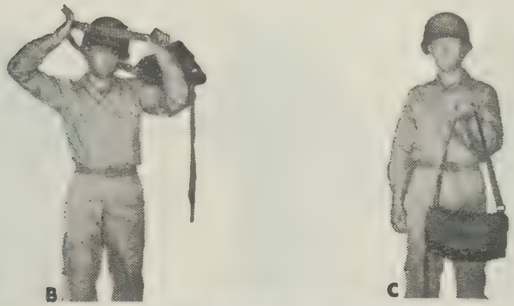
A Unfasten body strap. (Also unfasten harness snap on shoulder strap, if used.)

Figure 38—Continued.

LIGHTWEIGHT SERVICE MASK



B Move carrier to front. **C** Adjust length of body strap, if necessary, and refasten it.



B With both hands, grasp shoulder strap, raise it, and slide over head. **C** Hold shoulder strap in left hand, flap of carrier away from body.

Figure 38—Continued.

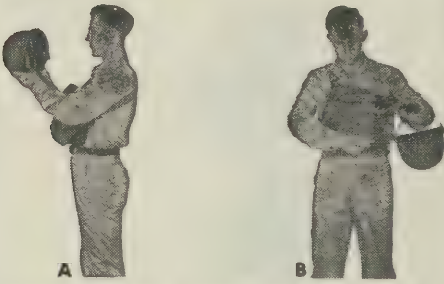
LIGHTWEIGHT SERVICE MASK

TO ADJUST MASK

"GAS"

NOTE:

When carrier is not in gas alert position or in back carry with pack position, adjust mask to face before adjusting carrier.



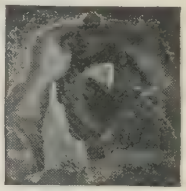
A Remove and dispose of head covering. **B** Open flap of carrier.

"TWO"

E Seat chin pocket of facepiece firmly under chin, holding head stationary. **F** Sweep head harness smoothly over head. **G** Make certain all head harness straps are straightened and head pad centered.

Figure 38—Continued.

LIGHTWEIGHT SERVICE MASK



C Grasp facepiece above eyepieces with right hand. **D** Remove facepiece from carrier, then grasp it with both hands. Place fingers straight and together on facepiece, immediately above eyepieces. Bring facepiece up in front of face. Thrust out chin.

Thumbs should be inside facepiece, at edge and under lower head harness straps.

H Seat facepiece snugly. Using palms of both hands, press backward and upward to remove all channels and irregularities.

"THREE"

I Close outlet valve by placing palm of right hand firmly over it. Exhale vigorously, clearing facepiece of gas. **J** Check mask by pinching hose near canister to shut off air supply. Inhale. No air should enter, and facepiece should tend to collapse against face.

Figure 38—Continued.

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LIGHTWEIGHT SERVICE MASK

(TO ADJUST MASK, continued)

"FOUR"

K

K Replace headpiece, then place carrier in proper position, viz:

Without Pack

L

If pack is not being worn, carrier must be retained at gas alert. **L** Fasten flap of carrier with hose coming out right side.

With Pack

L

M

N

If pack is worn, carrier can be placed at back carry: **L** Fasten flap of carrier, with hose coming out left side. **M** Lengthen shoulder strap by unfastening harness snap. **N** Bring left arm between hose and body, and again shorten shoulder strap by re-engaging harness snap.

Figure 38—Continued.

M Final position. Weapons and other equipment are returned to original positions.

O Bring carrier into position at left of pack, with hose over left shoulder. P Bring body strap around pack and fasten to sliding "D" ring on shoulder strap. Q Final position. Weapons and other equipment are returned to original positions.

Figure 38—Continued.

LIGHTWEIGHT SERVICE MASK

TO TEST FOR GAS

"TEST FOR GAS"


A


B


C

A Stoop, bringing face as close to ground as possible without touching person or equipment to ground. Take moderately deep breath, exhale part of it, then stop breathing. **B** Break seal of facepiece by grasping one of lower head harness tabs and pulling facepiece slightly away from face, letting air enter at that point. **C** Stand up and clear facepiece; then resume breathing.

TO REMOVE AND REPLACE MASK

"REMOVE AND REPLACE... MASK"


A


B

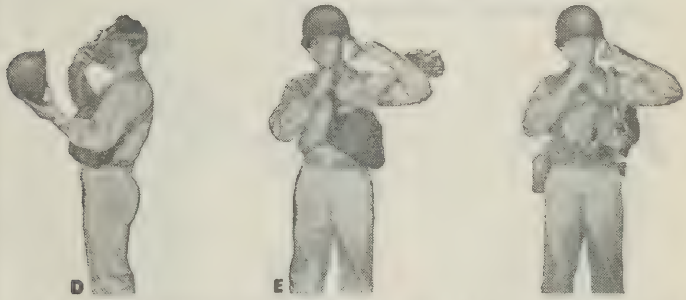

C

A Stoop and test for gas. **B** Stand up and clear facepiece. **C** If no gas has been detected, lift headpiece with left hand, and with right hand grasp facepiece below eyepieces.

Figure 38—Continued.

LIGHTWEIGHT SERVICE MASK

NOTE:
When testing for gas, don't touch face with hands; they may be contaminated.



D Remove facepiece with circular motion (pull downward, outward, and upward). **E** Hang facepiece over crook of left elbow and replace headgear.

If carrier is on back, allow facepiece to hang over left shoulder while replacing headpiece.

Figure 38—Continued.

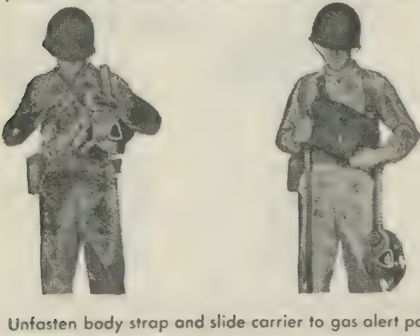
LIGHTWEIGHT SERVICE MASK

(TO REMOVE AND REPLACE MASK, continued)

"TWO"

F Grasp facepiece with right hand and crease head harness into it. **G** Open carrier with left hand while steadying it with hand holding facepiece. **H** Grasp canister with left hand and straighten canister straps. Loop hose around canister lengthwise, so canister can be placed inside facepiece with inlet valve at chin of facepiece.

IF CARRIER IS SLUNG AT THE BACK



Unfasten body strap and slide carrier to gas alert position.

Figure 38—Continued.

I With right hand, grip canister through facepiece, above eyepieces. Start hose loop into canister.

"THREE"

J Place mask in carrier and fasten flap. Then return carrier to original position.

Figure 38—Continued.

COMBAT SERVICE MASK

CARRYING POSITIONS

Side carry

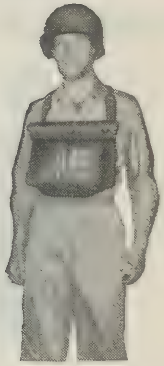
Side carry modified to front

Side carry modified to rear

Side carry with pack

Figure 39. Drill with combat service masks.

Leg carry



Chest carry

Back carry

Back carry with pack

Figure 39—Continued.

COMBAT SERVICE MASK

TO SLING AT SIDE CARRY

"SIDE CARRY... SLING, MASK"

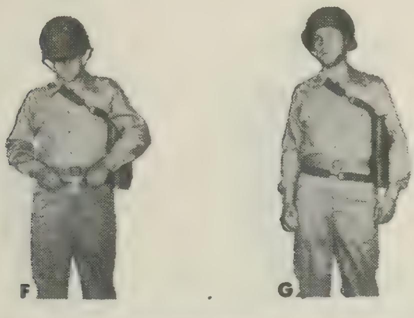
A Hold carrier in left hand by shoulder chape, waist high, with carrier closure to right (shoulder chape has one "D" ring, body chape has two). **B** Straighten shoulder strap and hold it extended, right hand gripping snap.

"TWO"

C Swing right arm to the left, then over head. Shoulder strap is thus passed around left elbow to wearer's back. **D** Bring shoulder strap over right shoulder and fasten snap. Strap is adjusted so distance between top edge of carrier and the armpit is about the width of a hand. **E** Fold up bottom flap of carrier.

Figure 39—Continued.

NOTE:
At side carry with pack, sling pack first.



F Lift carrier and place it securely against body, then fasten body strap. **G** Final position; mask may be shoved to front or rear (for modified front or rear side carry).

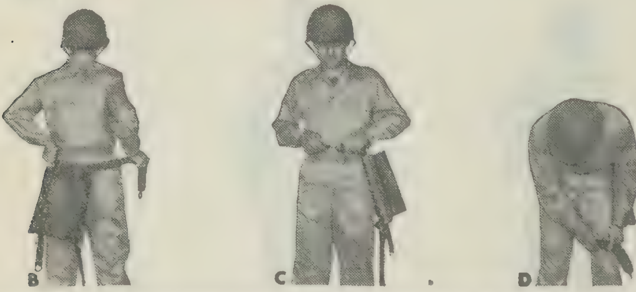
Figure 39—Continued.

TO SLING AT LEG CARRY

"LEG CARRY... SLING, MASK"

A At command, MASK, hold carrier in left hand by shoulder strap, waist high, with carrier closure to right.

"TWO"



B Swing carrier to left rear; reach behind body with right hand and grasp shoulder strap. Then . . . **C** Fasten shoulder strap around waist. **D** Shorten body strap.

Figure 39—Continued.

NOTE:

If possible, shoulder strap around waist should be positioned above the trousers belt.

E Raise carrier, fold the bottom flap up and under, and thread snap on body strap through "D" ring on chape. **F** Connect snap to "D" ring nearest carrier. **G** Final position.

Figure 39—Continued.

COMBAT SERVICE MASK

TO SLING AT BACK CARRY

*"BACK CARRY... SLING, **MASK**"*

A

A At command, MASK, hold carrier waist high in front of body, grasping body chape with left hand and shoulder chape with right. Front of carrier is toward body.

"TWO"

B

C

D

B Swing carrier over right shoulder. **C** Release shoulder chape from right hand, reach right hand around right side, and grasp shoulder strap. Bring it under right arm and across body, fastening it to body chape held in left hand. **D** Again grasp shoulder strap then reach around left side with left hand to grasp body strap. Bring it under left arm and across body, fastening it to shoulder chape.

Figure 39—Continued.

NOTE:
Mask cannot be adjusted from back carry.

Final position **E** from front, and **F** from rear. Both straps should be adjusted so that carrier is well up, and in middle of back.

Figure 39—Continued.

COMBAT SERVICE MASK

TO SLING AT CHEST CARRY

NOTES:

The combat mask is not designed for chest carry, but is often slung on the chest by seaborne assault troops because in this position the carrier provides more effective bouyancy in deep water. Moreover, seaborne troops are frequently so heavily laden with equipment that the chest is the handiest place to carry the mask. The mask must be moved to side, back, or leg carry immediately after the initial assault, because:

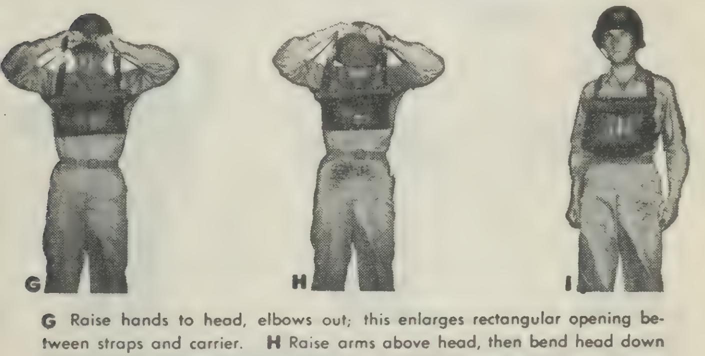
- *Chest carry interferes with proper use of natural cover, making it impossible to "hug" the ground.*
- *The wearer is apt to fall on his mask, damaging it and injuring himself.*
- *It is difficult to open the carrier and remove the mask at chest carry.*

The following procedure is not intended as a drill, but rather as a guide for slinging the mask at chest carry if needed.

A Fasten shoulder strap to body chape. **B** Fasten body strap to shoulder chape.
C Hold mask in left hand at intersection of straps.

Figure 39—Continued.

D Slip right hand underneath strap nearest body on right side, and grasp at intersection of straps. Release left hand. **E** Slip left hand underneath strap nearest body on left side. Then grasp straps farthest from body, as close as possible to intersection of straps. **F** Slide straps up over elbows, then flex arms outward. This moves straps far up on arms.



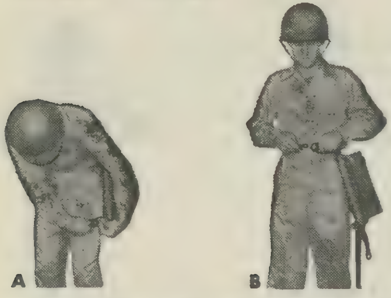
G Raise hands to head, elbows out; this enlarges rectangular opening between straps and carrier. **H** Raise arms above head, then bend head down and forward and slide strap over head. **I** Final position: Make certain straps are not twisted.

Figure 39—Continued.

COMBAT SERVICE MASK

TO UNSLING FROM LEG CARRY

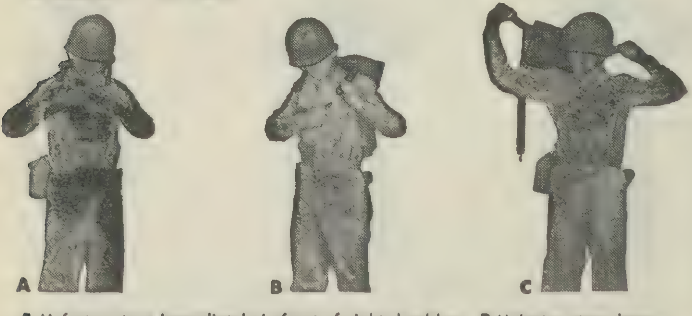
"UNSLING . . . MASK"



A Unfasten snap of strap around leg. **B** Unfasten strap around waist. **C** Hold carrier in left hand by shoulder chape, waist high.

TO UNSLING FROM BACK CARRY

"UNSLING . . . MASK"



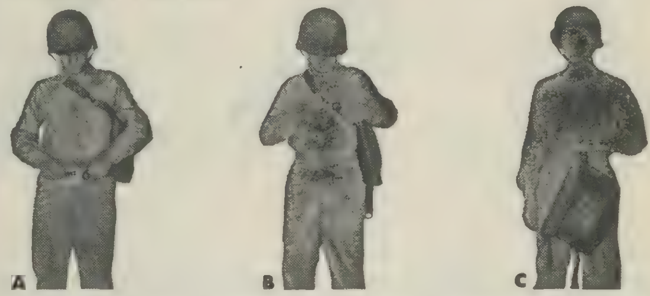
A Unfasten strap immediately in front of right shoulder. **B** Unfasten strap immediately in front of left shoulder. **C** Swing carrier over right shoulder to front of body.

Figure 39—Continued.

COMBAT SERVICE MASK

TO UNSLING FROM SIDE CARRY

"UNSLING . . . MASK"



A Unfasten body strap. **B** Unfasten shoulder strap. **C** Hold carrier in left hand by shoulder chape.

D Hold carrier in front of body, with body chape in left hand and shoulder chape in right.

NOTE:
When equipment is removed for any reason except for display, gas mask is retained on person.

Figure 39—Continued.

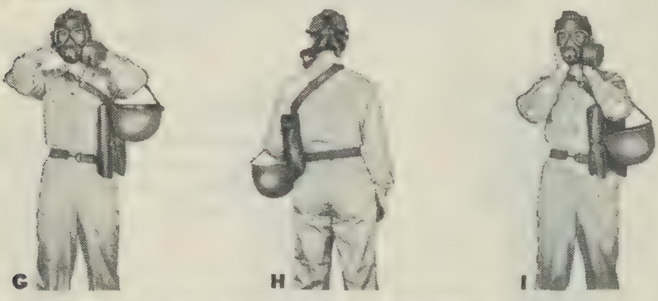
COMBAT SERVICE MASK

TO ADJUST MASK—SIDE CARRY

"GAS"

A Free both hands of equipment, then remove and dispose of headgear **B** Steady carrier with left hand, and with right hand open carrier closure. **C** Grasp back of carrier with left hand. reach into carrier with right, and grasp canister.

"TWO"



G Seat chin pocket of facepiece firmly on chin, holding head stationary; sweep head harness smoothly over head without twisting elastic webbing straps. **H** Make certain headpad is centered. **I** Seat edges of facepiece on face with upward and backward motion of palms. Press out all irregularities and channels.

Figure 39—Continued.


D


E


F

D Lift up on canister, thus removing mask from carrier. (Mask is horizontal.) **E** Turn mask around and grasp facepiece with both hands, sliding first left and then right thumb up inside facepiece under lower head-harness strap. F. Other fingers are placed straight and together on facepiece above eyepieces. Bring facepiece up in front of face, and thrust out chin.

"THREE"


J


K

Close outlet valve by cupping right palm firmly over it; exhale vigorously to clear facepiece of gas. **K** Check mask by placing left palm over canister air inlet, shutting off air. Meanwhile, grip canister with right hand. Inhale; no air should enter and facepiece should tend to collapse against face. Resume breathing.

Figure 39—Continued.

(TO ADJUST MASK, continued)

"FOUR"

L

M

L Replace head covering. M Fasten head harness neck strap.

TO TEST FOR GAS

"TEST FOR GAS"

A Stoop, bringing face as close to ground as possible. (But don't touch person or equipment to ground—it may be contaminated.) Take a moderately deep breath, exhale part of it, and stop breathing. Break seal of facepiece by grasping canister and pulling facepiece slightly away from face, letting air enter at that point. Sniff gently; do not inhale. Then release canister. *Reseat facepiece.*

A

Figure 39—Continued.

N

O

N Fold up closure, and... O Fasten it.

B Stand up and clear facepiece. Then resume normal breathing.

B

Figure 39—Continued.

COMBAT SERVICE MASK

TO REMOVE AND REPLACE MASK

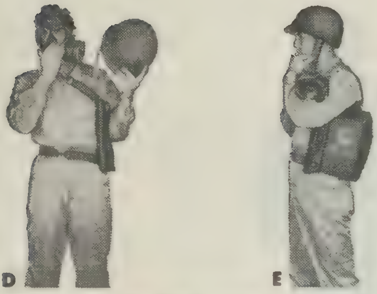
"REMOVE AND REPLACE...MASK"

A Test for gas by stooping, taking a deep breath, exhaling part of it, holding breath, breaking seal on facepiece, and sniffing. **B** Then stand up and clear facepiece. **C** If no gas is detected, lift headpiece with left hand, and with right hand unfasten head harness neck strap.

"TWO"

F Steady carrier with left elbow, and open closure with right hand. **G** Grasp mask by canister, facepiece on top, eyepieces toward body. Fold head harness into facepiece with left hand and start mask into carrier opening, chin pocket first.

Figure 39—Continued.



D With right hand, grasp facepiece below eyepieces. Remove facepiece with circular motion (downward, outward, and upward). **E** Place facepiece in crook of left elbow, and replace head covering.

"THREE"

H Push mask to back of carrier and rotate canister downward; thus facepiece is upright and eyepieces toward body. Press air out of carrier. **I** Fasten closure.

Figure 39—Continued.

SNOUT TYPE SERVICE MASK

CARRYING POSITIONS

Side carry

Side carry modified to rear

Side carry modified to front

Figure 40. Drill with snout type service mask.

Side carry with pack

Side carry modified to front, with pack

Leg carry

Figure 40—Continued.

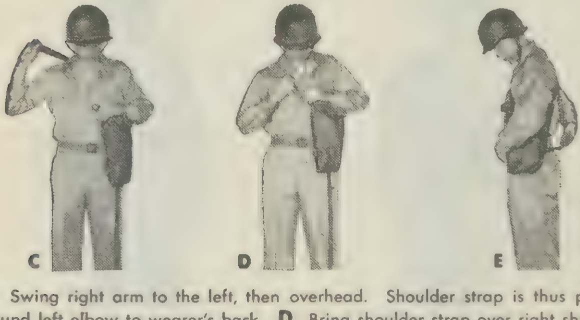
SNOUT TYPE SERVICE MASK

TO SLING AT SIDE CARRY

"SIDE CARRY... SLING, MASK"

A Hold carrier in left hand by shoulder chape, waist high with carrier closure up and away from body (shoulder strap is wider strap). **B** Straighten shoulder strap and hold it extended, right hand gripping snap.

"TWO"



C Swing right arm to the left, then overhead. Shoulder strap is thus passed around left elbow to wearer's back. **D** Bring shoulder strap over right shoulder and fasten snap. Strap is adjusted so distance between top edge of carrier and the armpit is about the width of two hands. **E** With right hand, reach around body, grasp body strap, straighten it, and...

Figure 40—Continued.

NOTE:
With field pack, sling pack first, then sling mask.


F


G

F Fasten body strap. **G** Final position, side carry; mask may be shoved to front or rear for modified front or rear side carry.

Figure 40—Continued.

SNOUT TYPE SERVICE MASK

TO SLING AT LEG CARRY

"LEG CARRY... SLING, MASK"

A

A Hold carrier in left hand by shoulder chape, waist high, with carrier closure up and away from body.

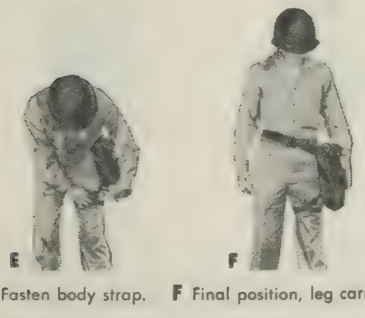
"TWO"

B C D

B Swing carrier to left rear; reach behind body with right hand and grasp shoulder strap. **C** Fasten shoulder strap around waist. **D** Fully extend body strap so it will wrap twice around leg (if leg is large, shorten strap completely to effect a snug, "once around" fit), and...

Figure 40—Continued.

NOTE:
If possible, shoulder strap around waist should be positioned above trouser belt.



E Fasten body strap. **F** Final position, leg carry.

Figure 40—Continued.

SNOUT TYPE SERVICE MASK

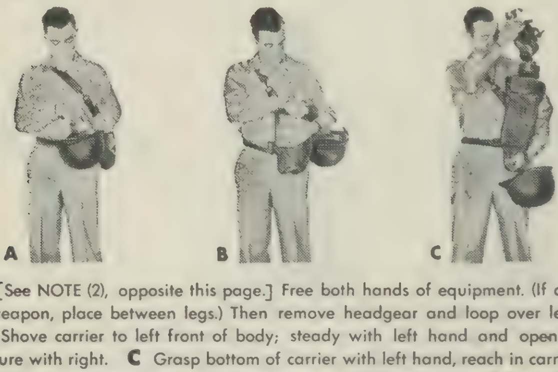
TO UNSLING FROM SIDE CARRY

"UNSLING, MASK"

A Unfasten body strap. **B** Unfasten shoulder strap, retaining grip on shoulder chape with left hand. **C** Hold carrier by shoulder chape, waist high.

TO ADJUST MASK

"GAS"



A [See NOTE (2), opposite this page.] Free both hands of equipment. (If carrying a weapon, place between legs.) Then remove headgear and loop over left arm. **B** Shove carrier to left front of body; steady with left hand and open carrier closure with right. **C** Grasp bottom of carrier with left hand, reach in carrier with right hand, and grasp facepiece above eyepieces. Lift until canister is free of carrier.

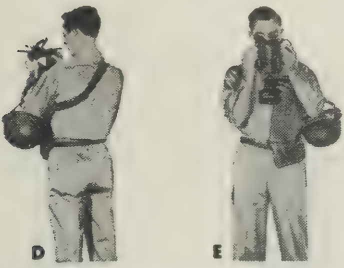
Figure 40—Continued.

SNOUT TYPE SERVICE MASK

TO UNSLING FROM LEG CARRY

"UNSLING, MASK"

A Unfasten band around leg. **B** Unfasten strap around waist, retaining grip on shoulder chape with left hand. **C** Hold carrier by shoulder chape, waist high.



D Grasp facepiece with both hands, sliding first left, then right thumbs up inside facepiece under lower head harness straps. **E** Other fingers are placed straight and together on facepiece above eyepieces. Bring facepiece up in front of face and thrust out chin.

NOTES:

(1) Adjustment is same from all carries.

(2) Without the numbers, at command GAS, immediately stop breathing. Ability to hold the breath for 30 seconds or more under conditions of excitement should be developed. Do not take another breath, even if breath has been exhaled, until facepiece is adjusted and cleared.

Figure 40—Continued.

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SNOUT TYPE SERVICE MASK

(TO ADJUST MASK, continued)

"TWO"

F Seat chin pocket of facepiece firmly on chin, holding head stationary; sweep head harness smoothly over head without twisting elastic webbing straps. **G** Make certain head harness pad is centered. **H** Seat edges of facepiece on face with upward and backward motion of palms. Press out all irregularities and channels.

"FOUR"

K Replace head covering and fasten helmet strap. **L** Fasten head harness neck strap. **M** Press air out of carrier and fold up closure.

Figure 40—Continued.

SNOUT TYPE SERVICE MASK

"THREE"

I

J

I Break seal of facepiece by placing both thumbs over the opening at bottom of rubber outlet valve cover and exhaling vigorously to clear facepiece of gas. (If mask is equipped with M8 outlet valve, break seal by placing right palm over it and exhaling vigorously.) **J** Check mask by placing heel of right hand over canister air inlet, shutting off air. Inhale and hold the breath for 2 to 5 seconds. The facepiece should partially collapse, and no air should enter. It should not begin to regain its normal shape as long as the breath is held.

N

O

N Fasten closure and return carrier to side carry position. **O** If T of Opns will not allow the helmet strap to be fastened under chin, helmet may be slung over canteen or over muzzle of leg-supported rifle. If rifle is not on person, the helmet may be placed between legs.

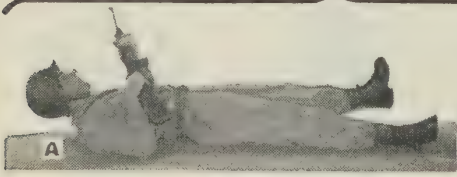
Figure 40—Continued.

SNOUT TYPE SERVICE MASK

"GAS"

TO ADJUST MASK
(FROM PRONE POSITION)

AT SIDE CARRY



A Roll over on right side until flat on the back. **B** Free both hands of equipment and remove headgear, placing equipment and headgear on the body to minimize contamination. **C** Pull carrier over chest. See NOTE, opposite page.

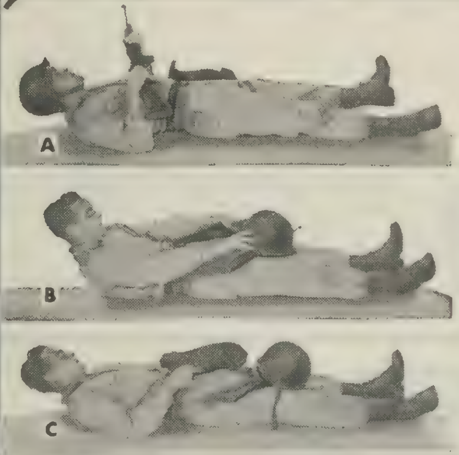
AT SIDE CARRY MODIFIED TO REAR

A Roll over on right side and pull carrier over chest. **B** Then lie flat on the back, free both hands of equipment, and remove headgear, placing equipment and headgear on the body to minimize contamination. See NOTE, opposite page.

Figure 40—Continued.

SNOUT TYPE SERVICE MASK

AT LEG CARRY



A Roll over on right side until flat on the back. **B** Free both hands of equipment and remove headgear, placing equipment and headgear on the body to minimize contamination. **C** Pull carrier to front of leg. See NOTE, bottom of page.

NOTE:

Subsequent steps for adjustment of mask follow the same procedure shown on preceding pages, steps B to M, regardless of whether mask is at side carry or leg carry.

Figure 40—Continued.

SNOUT TYPE SERVICE MASK

TO TEST FOR GAS

"TEST FOR GAS"

A Stoop to bring face as close to ground as possible. (But don't touch person or equipment to ground — it may be contaminated.) Take a moderately deep breath; exhale part of air and stop breathing. Break seal of facepiece by pulling lower head harness tab away from cheek to permit air to enter at that point; sniff gently, but do not inhale. Reseal the facepiece and . . .

TO REMOVE AND REPLACE MASK

"REMOVE AND REPLACE, MASK"

A Test for gas by stooping, taking a deep breath, exhaling part of it, holding breath, breaking seal on facepiece, and sniffing. **B** Then stand up and clear facepiece. **C** If no gas is detected, lift headpiece with left hand and with right unfasten head harness neck strap.

Figure 40—Continued.

SNOUT TYPE SERVICE MASK

B

B Stand up and clear facepiece by placing both thumbs over the opening at bottom of outlet valve cover and exhaling vigorously. Then resume normal breathing. (If mask is equipped with M8 outlet valve, clear facepiece by placing palm over it and exhaling vigorously.)

D E

D With right hand, grasp canister and, with a circular motion (downward, outward and upward), remove facepiece. **E** Replace head covering and place mask in crook of left elbow, eyepieces down, canister at left breast, and fasten helmet strap.

Figure 40—Continued.

SNOUT TYPE SERVICE MASK

(TO REMOVE AND REPLACE MASK, continued)

"TWO"

F G H

F Steady carrier with right hand and open closure with left hand. **G** Fold head harness into facepiece with right hand. **H** Grasp mask with right hand above eyepieces; raise it above carrier so that mask faces right. Start mask into carrier opening, canister first.

"THREE"

I J

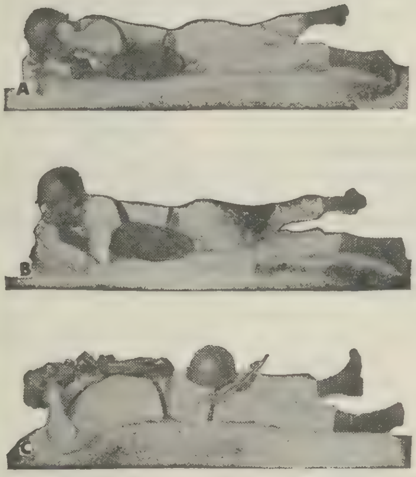
I Push mask to bottom of carrier and press air out of carrier. **J** Fasten closure.

Figure 40—Continued.

SNOUT TYPE SERVICE MASK

TO REMOVE AND REPLACE MASK
(FROM PRONE POSITION)

"REMOVE AND REPLACE, MASK"



A Test for gas by taking a deep breath, exhaling part of it, holding breath, breaking seal on facepiece, and sniffing. **B** Then clear facepiece. **C** If no gas is detected, roll over on back, free both hands of equipment, and remove headgear. Pull carrier over chest and unfasten head harness neck strap. Then proceed with removal and replacement of mask as shown in D through J on two preceding pages.

NOTE:

It is advisable that a low silhouette be maintained at all times during adjustment, removal, and replacement of the mask from a prone position. If adjustment is more comfortable from the right side or if a large pack is on the back, it may be easier to make all adjustments and the removal and replacement from the right side rather than the back position. This is the less preferred method as the silhouette is heightened.

Figure 40—Continued.

SERVICE MASK

TO SLING MASK

"SLING . . . MASK"

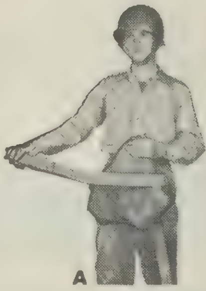
NOTES:

Shoulder strap slides should be adjusted so that stitched-in offset in center of strap rests directly on right shoulder.

Distance between top edge of carrier and armpit should be about the width of a hand.

Body strap is lengthened or shortened with body strap slide.

If carrying full field pack, sling mask before slinging pack. Left front suspender strap of pack is passed under gas mask shoulder strap. (Medical personnel carrying medical private's kit must sling mask after slinging kit, however; kit is slung with one pouch in normal position at front of right hip, while other pouch is carried in front of chest.)



A At command MASK, hold carrier by left hand near shoulder strap eye clasp, waist high, in front of body; flap and snap fasteners are next to body. Straighten shoulder strap and hold extended in right hand, palm upward.

Figure 41. Drill with service mask.

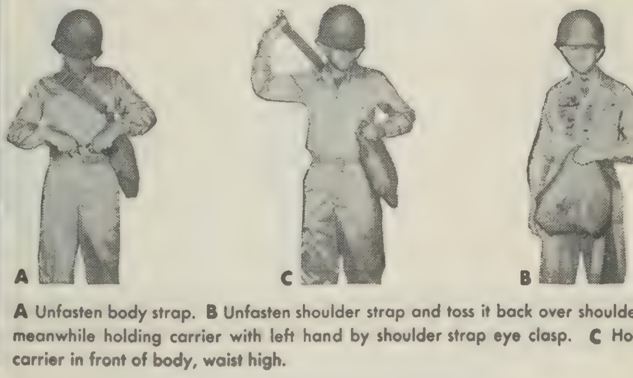
SERVICE MASK

"TWO"

B Swing right arm in arc to left and over head, passing shoulder strap around left elbow. **C** Bring strap down over right shoulder; then fasten it to shoulder strap clasp. **D** Fasten body strap around waist.

TO UNSLING MASK

"UNSLING . . . MASK"



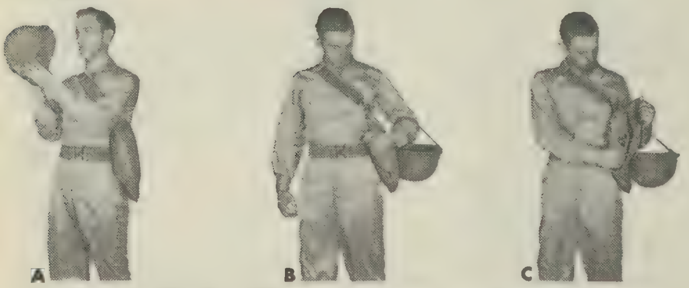
A Unfasten body strap. **B** Unfasten shoulder strap and toss it back over shoulder, meanwhile holding carrier with left hand by shoulder strap eye clasp. **C** Hold carrier in front of body, waist high.

Figure 41—Continued.

SERVICE MASK

TO ADJUST MASK

"GAS"

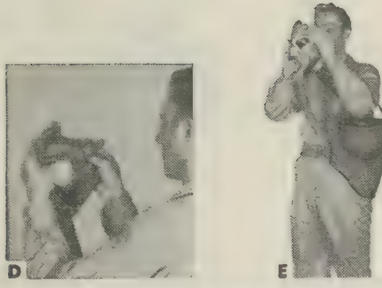


A At command GAS, free both hands, then remove and dispose of headgear. **B** Open carrier flap with left hand. **C** With right hand, grasp facepiece just below eyepieces and pull it out of carrier.

"TWO"

F Seat chin pocket of facepiece firmly on the chin, keeping head stationary. **G** Then sweep head harness smoothly over head without twisting elastic webbing straps. **H** Center the head pad.

Figure 41—Continued.



D Grasp facepiece in both hands. Slide thumbs under lower head harness straps. Hold other fingers straight and together above eyepieces. **E** Bring facepiece up in front of face. Thrust out chin.

I Seat facepiece, using upward and backward motion with palms of both hands to press out channels.

Figure 41—Continued.

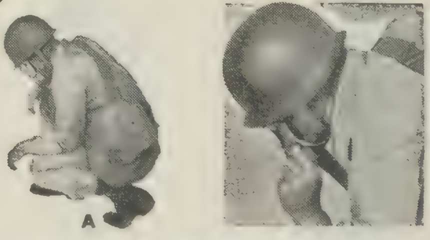
(TO ADJUST MASK, continued)

"THREE"

J Close outlet valve and exhale vigorously to clear facepiece of gas. **K** Check mask by pinching hose near canister to shut off air supply. Inhale. No air should enter, and facepiece should tend to collapse. Release hose and resume breathing.

TO TEST FOR GAS

"TEST FOR GAS"



A Stoop, bringing face as close to ground as possible without touching it. Take moderately deep breath, exhale part of it, then stop breathing. **B** Break seal of facepiece by grasping one of lower head harness tabs and pulling facepiece slightly away from face, permitting air to enter at that point.

Figure 41—Continued.

SERVICE MASK

"FOUR"

L

M

N

L Replace headgear. **M** Turn head to right, thus drawing full length of hose from carrier. While in this position, fasten carrier flap over hose (using fastener nearest hose). Also snap lower carrier fastener **N** Final position. Return equipment to normal carrying position.

C

C Stand up, clear facepiece, and resume breathing.

NOTE:

When testing for gas, don't touch face with hands—they may be contaminated.

Figure 41—Continued.

SERVICE MASK

TO REMOVE AND REPLACE MASK

"REMOVE AND REPLACE . . . MASK"

Test for gas: **A** Stoop to ground, breathe, exhale part of air, and hold breath. **B** Break facepiece seal and sniff.

E With circular motion (downward, outward, and upward) remove facepiece. **F** Place facepiece in crook of left elbow and replace headgear.

Figure 41—Continued.

C Stand up and clear facepiece. **D** Lift headgear with left hand, at same time grasping facepiece below eyepieces with right hand.

G Grasp facepiece in right hand and hold it chest high, open side up.

Figure 41—Continued.

(TO REMOVE AND REPLACE MASK, continued)

"TWO"

H With left hand, fold head harness inside facepiece. **I** Open flap of carrier with left hand, and pull out slack of hose. **J** With right hand, bring facepiece toward carrier; with left hand, loop hose through facepiece holding hose in this position with thumb and fingers of right hand. Make certain hose is not kinked.

"THREE"

L Insert facepiece in carrier, hose at bottom. Keep facepiece erect, eyepieces to front. **M** Release grip on facepiece *below* eyepieces and grasp again *above* eyepieces. Shake facepiece to settle hose loop into position. **N** Refasten carrier.

Figure 41—Continued.

K

K Hold carrier flap open with left hand; then insert loop into carrier.

O

O Final position.

Figure 41—Continued.

APPENDIX VII

PROTECTIVE COVER: USE AND DRILLS

1. PROCEDURE FOR SPRAY GAS ATTACK. Procedures for defense against airplane spray attack are incorporated by each unit commander into the SOP for aerial defense. These procedures vary locally, but, in general, they follow the pattern given below:

a. Tear off top portion of outer wrapping of protective cover (exposing red tabs) before stowing in gas mask carrier. This makes extraction of the cover easier in emergency.

b. Wear eyeshields at all times under conditions of gas warfare when spray attack is a possibility.

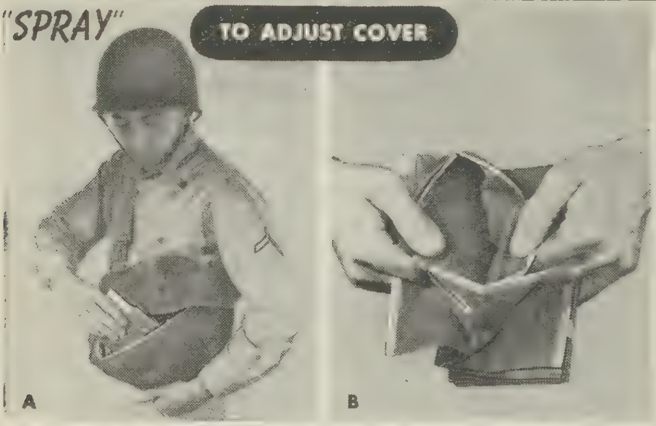
c. When the cry SPRAY! is heard, put on the protective cover. (If there is not time to adjust the cover before becoming contaminated, do not put it on at all. It will only trap vapors inside.) After the cover is put on, the rifle or carbine may be thrust through the corner to fire at attacking aircraft. At the first opportunity, discard the eyeshields, decontaminate the eyes and skin if necessary, adjust the mask, and decontaminate personal equipment if the cover was not adjusted during the spray attack.

d. After cover has been adjusted, take off the eyeshields, and adjust the mask—all this before removing the cover. After the spray attack is past, discard the contaminated cover.

e. Protective covers are not used when they interfere with normal functions of specially designated personnel.

2. DRILLS. Drills given here for use of the cover should be executed at ease, movements being carried out slowly until speed and efficiency are attained through practice. A thoroughly trained soldier can adjust his cover in about 8 seconds. If handled carefully, covers used for training can be refolded and reused as many as 25 times.

PROTECTIVE COVER

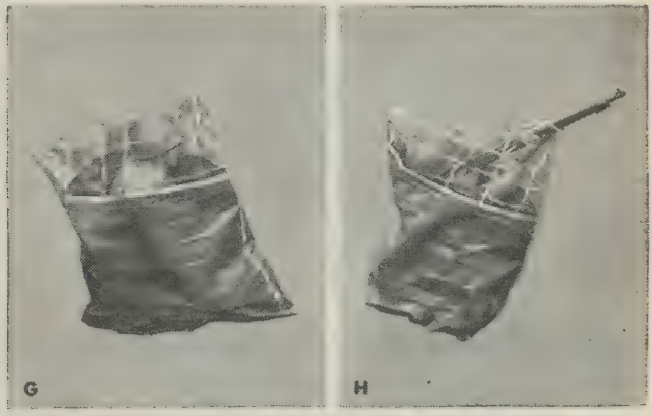


A Open flap of gas mask carrier and withdraw protective cover with right hand. (End of envelope has been torn off beforehand.) **B** Remove envelope, then grasp two red tabs of cover, one in each hand, between thumbs and forefingers.

C Retaining grip on tabs, release rest of cover and unfold it toward ground by means of a quick downward flip of the wrists. **D** Swing cover backward to right, meanwhile spreading hands 12 to 14 inches apart.

Figure 42. Drill with protective cover.

E Then swing forward to fill cover with air, as you would a paper sack. **F** Swing cover upward, then sweep it down over body.



G Crouch, thus covering entire body. **H** In actual combat, the rifle or carbine may be thrust through a top corner of the cover, permitting the wearer to fire at attacking aircraft, if so ordered.

Figure 42—Continued.

PROTECTIVE COVER

"REMOVE . . .
COVER"

A At command COVER, lean forward, with back toward wind.

B Then push cover off to the front, but do not let hands touch outside of cover.

Figure 42—Continued.

PROTECTIVE COVER

A At command COVER, refold from side to side along original folds. **B** Then fold from top down, pressing out air by holding cover against chest.

C Put cover back in envelope. **D** Replace enveloped cover in gas mask carrier.
NOTE: Covers are replaced during training only.

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